Water Supply & Demand Management Policy Report

City of Fort Collins
Utilities

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1.0 Introduction

1.1 Purpose

On September 16, 2003, City Council adopted the Water Supply and Demand Management Policy. The purpose of this report is to provide supporting documentation for the adoption of the policy as well as provide a review of the City's previous water supply and demand management policies. The original water supply and demand management policies were adopted by the City Council in 1988 and 1992, respectively. During this period the City has continued to grow quite rapidly and acquired additional supplies, while the per capita water use has dropped by over 15%. In addition, the City's future is increasingly intertwined with other water agencies and organizations, which creates new challenges and opportunities. A review of the previous policies and the formulation of the newly adopted policy will help guide the Fort Collins Utilities in the years ahead.

1.2 Historic Review of City Water Supply

From the Water Utility's origin in the 1880s, until the early 1960s, the City depended primarily on its direct flow rights on the Cache la Poudre River (Poudre River) to satisfy its water demands. The first water right was obtained in 1889 when the City Council purchased a direct flow water right of 4.0 cubic feet per second (cfs). In 1904 another 2.65 cfs was purchased and the right was moved by decree to the present diversion dam near the former Poudre Canyon Water Treatment Plant. Three other senior direct flow rights were subsequently obtained in the early 1900s. These five direct flow decrees served the City well for many years and still entitle the City to divert an average of about 11,300 acre-feet of water annually.

In the late 1950s the City acquired 6,000 units of Colorado-Big Thompson (CBT) water which had been made available by the completion of the CBT Project. CBT water is diverted from the upper Colorado River and stored in Lake Granby, Horsetooth Reservoir and Carter Lake. This project is managed by the Northern Colorado Water Conservancy District, which has a key role in providing supplemental water supplies to Colorado's northern Front Range.

During the dry years of the 1950s, enough growth had occurred that the City began to experience water shortages. The City attempted to purchase substantial amounts of water from existing irrigation ditches, but it failed to adequately consider the legal limitations, which would constrain the use of such water. The result was an historic legal battle that reached the Colorado Supreme Court, and Fort Collins was denied the ability to implement these plans because they were ruled to be injurious to other water users of the basin. An additional detriment was the ill feelings that were generated between the residents of the City and the rural community. As a result of the frustration that occurred in the 1950s, Mr. Harvey Johnson (then mayor) suggested in 1963 that a Water Board be established to recommend solutions to the City's water supply problems. The Board contained a cross section of water professionals who were knowledgeable about the Poudre River Basin water system and its operation. Cooperation and harmony among all water users in the basin – municipal and agricultural – was recognized as crucial. To that end, the Board conferred with the Cache la Poudre Water

Users Association on every action that could impact others before making a recommendation to the City Council. Problems related to the withdrawal of water acquired in mutual irrigation companies were resolved through negotiated agreements with the irrigation companies. Potential conflicts were resolved in that process to the extent that litigation was essentially eliminated. The Board also adopted the policy that water would not be sought from agricultural water rights owners except when the land was being developed or it was offered for sale as excess to the owner's irrigation needs. This was intended to avoid disruption in the agricultural economy of the basin. These policies for water right acquisition by the City laid the foundation for more than two decades of basin water user cooperation.

Shortly after the Water Board was formed, the City began an active water acquisition program. From 1963 to 1972, the City acquired shares of stock in several local irrigation companies. During this period, approximately 840 shares of the North Poudre Irrigation Company (NPIC) were purchased as well as 60 shares of the Pleasant Valley and Lake Canal Company and about 4,000 more units of CBT water. In 1972, 9.917 shares of the Water Supply and Storage Company (WSSC) were purchased. These purchases resulted in an increased average annual yield of about 11,000 acre-feet per year above the yield from the historic direct flow rights.

During this same period of water purchases, the Water Board and City Council established a policy that required developers to turn over water to the City prior to receiving water service. Initially there was a requirement of 2 acre-feet per acre but this was changed to 3 acre-feet per acre in the early 1970s. This requirement remained until 1984 when the raw water requirements were revised to reflect more closely the actual amount of water used by various classes of customers. The present requirements for residential development are based on a formula that considers both area and number of dwelling units. Non-residential requirements are based on tap size, or for large water users, are negotiated based on estimated water use. The water rights transferred to the City under these requirements include CBT units and shares of several irrigation companies that have historically irrigated in the Fort Collins area.

In the mid 1970s, the City decided to enlarge Joe Wright Reservoir and improve the Michigan Ditch, both located near Cameron Pass on Highway 14. The City had obtained both of these facilities in an exchange with the NPIC in 1971. The enlarged reservoir, with a usable capacity of 6,500 acre-feet, was completed in late 1979. The rebuilding of Joe Wright Reservoir prompted several other related projects. The enlarged reservoir and the ability to divert trans-basin waters from the Michigan River (part of the North Platte River Basin) resulted in reusable waters being brought into the Poudre River Basin. Reusable water refers to imported or newly developed water that may be totally consumed through a succession of identified uses by its owner. In 1978, the City entered into an agreement with Platte River Power Authority (PRPA) and the WSSC to jointly participate in a "Reuse Plan". Under the plan, PRPA takes reusable effluent resulting from the City's and WSSC's reusable sources. PRPA repays the City and WSSC with other water. This joint Reuse Plan results in an additional 2,300 acre-feet available to Fort Collins. Also related to the Joe Wright and Michigan Ditch facilities is the 1,200 acre-feet of storage capacity acquired in 1983 in Meadow Creek Reservoir. The City purchased this capacity in the Michigan River Basin in order to provide replacement water for senior appropriators in that basin. This allows the City

to divert more water through the Michigan Ditch during times of high irrigation demand. The average annual yield of Joe Wright Reservoir, Michigan Ditch and Meadow Creek Reservoir is estimated to be 5,500 acre-feet per year.

From 1985 through 1988, the City purchased about 5,500 acre-feet of water, primarily CBT units and NPIC shares. These purchases were primarily because of a decline in the price of water rights in this area and because of concerns related to the purchase of almost half of the shares in the WSSC by the City of Thornton.

After a thorough review of the City's policies concerning water supply in 1987, the Water Supply Policy (Resolution 88-205) was established in 1988 (see Appendix A). This policy required that the Water Utility maintain a water supply sufficient to meet the treated water demands of the City during at least a 1-in-50 year drought. To accomplish this goal for the long term, another 7,400 acre-feet of water was purchased during 1989-1991. Also, the raw water requirements were increased by 20% to ensure that developers were turning in enough water to meet the long-term goals.

During the last decade, significant actions by the Water Utility have occurred that may have a long-term effect on the City's supply system. In 1992, the City filed a major application with the Water Court to transfer shares of its "Southside Ditches" from agricultural use to municipal use. The shares involved in this transfer included those from the Arthur, Larimer No. 2, New Mercer and Warren Lake irrigation companies. After several years of study, negotiations and Water Court hearings, the City obtained a decree in 1996 that allows the City to use much of this water in its system. In 1993, the City entered into an option agreement with NPIC to acquire and enlarge its existing Halligan Reservoir if studies should confirm its feasibility. In November 2003, the City Council approved the exercise of the NPIC option agreement, which transferred the reservoir ownership and enlargement decree to the City. The enlargement of Halligan Reservoir could provide the City with carryover storage that provides drought protection.

During the first 120 years of water service in Fort Collins, water supply policies have focused on meeting the residential, commercial and industrial water supply needs of the citizens served by the Water Utility. These policies have evolved over the years to meet the changing needs and desires of the City's residents.

1.3 Historic Review of City Water Demand Management

Demand management measures include actions aimed at controlling the demand for water. Some measures are used for short-term water shortages caused by drought or water supply crises. Other measures are used for long-term water conservation, which help to reduce overall demands and aid in the planning for supply system acquisitions and improvements.

Early Fort Collins settlers realized how precious water was to this semi-arid land. They hauled water in buckets and there was no need to convince them to not be wasteful. But as indoor plumbing became standard in Fort Collins, the perceived need for conservation dwindled. It wasn't until the 1960s, when Fort Collins began to acquire additional water supplies in

anticipation of future growth, that an awareness of conservation began to emerge. At that time, two ordinances were enacted. One of the ordinances prohibited wasting water while irrigating lawns and the other gave Council the authority to impose water restrictions when necessary.

The City's conservation efforts began in earnest when Fort Collins was faced with a drought in 1977. During the drought, water restrictions were imposed and a part-time water conservation officer was hired. This position was charged with enforcing the water restrictions, talking to groups and schools about conservation, and working with the media to publicize the restrictions and ways to conserve. The restrictions were only in effect for just over a month because of an abundance of late summer rain.

For a number of years, the idea of installing water meters in homes was often studied, discussed and voted down. The first step was taken in 1977 when Council passed an ordinance that required a meter yoke be installed in all newly-built homes. Yokes ease installation of a meter at a later date. City Council eventually moved to require meters in response to the Colorado Water Metering Act of 1990. Although the State law required that all water taps be metered by January 2009, City Council moved the deadline to December 2005. The program began as voluntary, but became mandatory in 1999. By the summer of 2003, all City water taps had been metered. Studies have shown that metered households use about 20% less water annually than those without meters. Installing meters in Fort Collins homes has played an important role in lowering water demand. It should be noted that the City's commercial, industrial and multi-family customers have been metered for many years.

Low water use plumbing fixtures have helped reduce indoor water use. In 1978, a City ordinance was adopted that required plumbing fixtures to meet flow requirements of 3.5 gallons per flush for toilets, 3 gallons per minute for showerheads and 2 gallons per minute for faucets. When the federal Energy Policy Act of 1992 became effective, Fort Collins plumbing fixtures were further reduced to 1.6 gallons per flush for toilets, 2.5 gallons per minute for showerheads and 2 gallons per minute for faucets.

Approximately 40% of the City's treated water supply is used for keeping landscapes green. With this in mind, the City initiated several programs to reduce outdoor water use. Beginning in 1982, the Utilities published a daily lawn watering guide in the *Coloradoan* based on evapotranspiration (ET) data. The guide shows how much water a lawn might need if it hasn't been watered for three, five or seven days. Professor ET, a cartoon character, provided outdoor water conservation tips to the public. In 1986, a Xeriscape Demonstration Garden was opened in front of City Hall to show customers that landscapes that use less water can be attractive.

In 1989, the Utilities hired a full-time water conservation specialist, and conservation projects and education efforts were expanded. An initial duty of this position was to participate in the development of a water conservation policy for the City. A committee was formed to develop this policy, including members of City Council, the Water Board and Utilities staff. After almost two years of analyzing various measures, City Council passed the Water Demand Management Policy (Resolution 92-63) in 1992 (see Appendix B). Since then, the policy's 12

demand management measures have been the foundation of the City's water conservation program. The 1992 policy also set two goals for lowering overall water consumption and peak day demand.

Due to severe drought conditions in 2002, additional water conservation was required to avoid potential water supply shortages in 2003. In July 2002, mandatory restrictions were put in place allowing customers to water their lawns two days per week. In the fall of 2002, revised restrictions allowed just one day per week. Water savings from the restrictions and other water conservation efforts were carried over for use in 2003.

As 2003 began, drought conditions continued, raising concerns of a significant water shortage. A historic blizzard in March and a wet, cool spring quickly changed the situation. Uncertain what the future would bring, Council adopted the Water Supply Shortage Response Plan (Ordinance No. 048, 2003, included as Appendix C) with four levels of measures to address various water shortages. In April 2003, Level 1 water restrictions were put in place to meet a projected 1-10% water shortage. These restrictions remained in place until September 2003, when demands were lower and supply projections had improved.

As the City's population continues to grow and drought cycles inevitable, it becomes increasingly challenging to meet future water needs. Over the years, the demand management policy and other conservation efforts have lowered the per capita consumption and contributed to the City being able to meet its water demands.

1.4 Drought Considerations

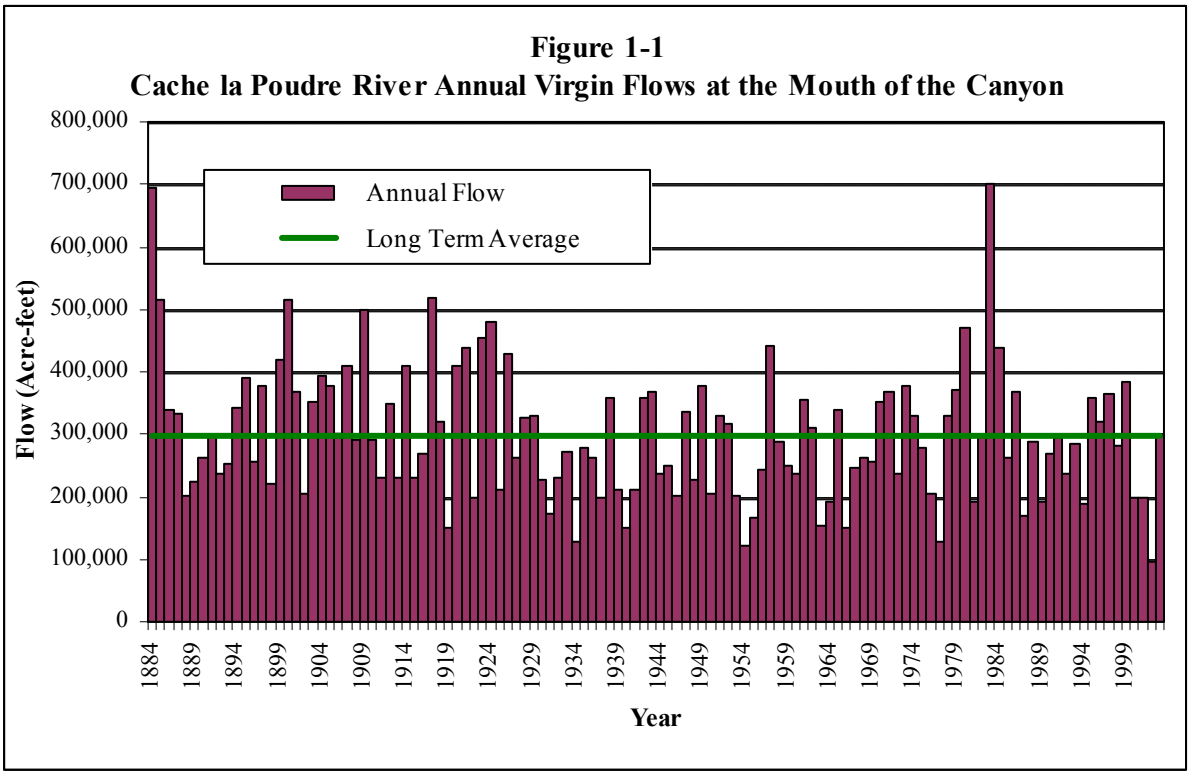
1.4.1 General Drought Information

Fort Collins is located in a semi-arid region of the west, which is more prone to droughts than other parts of the United States. The highly variable nature of precipitation in this area makes long-term planning essential if the Utility is to provide an adequate and reliable water supply to its customers. This report and the Water Supply and Demand Management Policy detail these planning efforts.

Dictionaries define drought as an "absence of moisture" or "prolonged shortage of water". Drought can be considered a period with below average precipitation, when the demand for water exceeds the available supply or when there are projected shortages of water. Since a large portion of the water supplies available to the City comes from the Poudre River, the City defines a drought as below average annual runoff on the river (see section 6.3.2).

The Poudre River is certainly subject to droughts as shown in Figure 1-1, which illustrates the variability of flows on the river. The individual bars on the graph show the virgin (or native) annual discharge from 1884 through 2003. The straight line on the graph denotes the long-term average for these flows. According to the City's drought definition, droughts can be identified on the graph as years that the flow is below the average line for a given year or a continuous period.

Figure 1-1
Cache la Poudre River Annual Virgin Flows at the Mouth of the Canyon



1.4.2 Recent Drought Conditions (2000-2003)

Based on the City's definition of drought and the fact that runoff on the Poudre River has been below average for the last few years, the City has been experiencing drought conditions since 2000, as shown in Figure 1-1. In 2002, the drought became very prominent, as water supplies in the Poudre River Basin were severely reduced due to the lowest flow on the river in recorded history. Water year 2003 was very nearly an average runoff year and is questionable as a drought year when defined by runoff. However, the effects of the severe conditions in 2002 greatly depleted water sources in the Poudre River Basin for 2003. Based on a potential supply shortage in 2003, the City implemented watering restrictions to reduce demands and carry over as much water as possible into 2003. The improved runoff conditions in 2003, along with the diligent conservation efforts of Utility customers and the watering restrictions that remained through most of 2003, helped the City to recover its water supplies for 2004. It is not known how long drought conditions will continue.

Throughout this report, there are numerous references to the recent drought (usually referred to as the "recent drought (2000-2003)"). Although the drought has been a difficult time for the Utility and its customers, lessons have been learned that will likely result in long-term water conservation by Utility customers and better planning by the Utility.

2.0 Review of 1988 Water Supply Policy

2.1 Background

The 1988 Water Supply Policy included seven general policy elements, which were intended to guide the City as it considered issues regarding water supply. A copy of Resolution 88-205, which was adopted by City Council on December 20, 1988, is included as Appendix A. These policy elements are briefly reviewed below and actions specific to each are described.

2.2 Review of 1988 Policy Elements

2.2.1 Cooperation with Agricultural Community

The policy stated, "*The City should continue to be sensitive to the effects that City acquisition policies have on the agricultural community*."

This policy recognized that most of the new water supply that the City acquires has been previously used for agricultural irrigation and can affect the agricultural community. Much of the City's new supply during the last few decades has come from shares in mutual irrigation companies that have irrigated the lands which are being urbanized by Fort Collins. Some of the water, primarily Colorado-Big Thompson Project (CBT) units and North Poudre Irrigation Company (NPIC) shares, have come from rural areas. Many of the farmers who have sold water to developers for satisfaction of the City's raw water requirements have benefited by having an active water market available to them. As the City has become a larger shareholder in several of the local irrigation companies, it has tried to work cooperatively to help maintain a viable irrigation system for the remaining agricultural shareholders. The City continues to pay maintenance assessments on shares used outside the system, leaves a proportionate amount of water in each system to help with seepage losses and rents surplus water to shareholders of these companies. In addition, several City employees serve as directors on irrigation company boards to help manage the companies.

About 85% of the water used in the Poudre River Basin continues to be for irrigating crops or for rural uses. Because of this, the primary source for additional supplies is through the acquisition of agricultural water rights, which is likely to have some effect on the agricultural community. It is important that the City work closely with the irrigation companies and others in evaluating and considering the effects on all water users in the basin.

2.2.2 Reliability of Supply

The policy stated, "*The reliability of the Fort Collins water supply should be maintained to meet at least the 1-in-50 drought event.*"

As a result of the 1988 Water Supply Policy, several measures were taken to provide a water supply that would meet at least the 1-in-50 drought criteria for many years to come. First, the raw water requirements for new development were increased by 20% in 1989. Second, 7,400 acre-feet of water was purchased in 1989 and 1990 in order to meet the long-term target of

having a supply adequate for at least a 1-in-50 drought. Chapters 4 and 6 of this report further evaluate the present and future firm yield of the City's water supply system.

The amount of water needed for the future is dependent on growth, demand level and the reliability of the supply. A drought study completed in the mid-1980s provided a method by which water supply reliability can be measured in terms of probability of certain droughts occurring. By simulating the City's future supply through different droughts, the amount of supply needed for each type of drought was determined. After comparison of several drought scenarios, the 1-in-50 drought criteria was adopted as part of the 1988 Water Supply Policy.

2.2.3 Timing of Acquisitions

The policy stated, "*Water supplies that help balance the City's present raw water system should be acquired ahead of the time it is needed to meet the 1-in-50 reliability criteria.*"

This policy element was adopted primarily to provide guidance for the water purchases called for in the 1988 Water Supply Policy. It recognized that as the price of water in the area was very low compared to past and future prices, it was economically desirable to obtain supplies ahead of the time they were needed. All of the 7,400 acre-feet were purchased within a couple of years of adoption of the policy, while water prices were relatively low.

2.2.4 Process of Acquiring Water Rights and Storage

The policy stated, "*The City should evaluate opportunities as they arise and obtain the most desirable sources of water. These opportunities may include acquisition of water stock or CBT water, lease arrangements, and the development or rehabilitation of reservoirs.*"

During acquisition of the 7,400 acre-feet of water in 1989 and 1990, the City was primarily offered water rights routinely accepted from local developers. This included significant quantities of CBT water and NPIC shares, both highly reliable sources of water. In 1993 the City entered into an agreement with NPIC to reserve the option of acquiring and enlarging Halligan Reservoir. This provided a way to reserve potential storage capacity while delaying the expenditures of large sums of money. Other less significant opportunities to purchase water rights have been evaluated from time to time during the last decade.

2.2.5 Raw Water Requirements for New Development

The policy stated, "*The raw water requirements (RWR) for new development should be set such that with other water acquisitions, the total water supply available is adequate to meet or exceed a 1-in-50 drought over the long term.*"

In response to the 1988 policy, the raw water requirements were increased by 20%. This action, in conjunction with purchasing additional water, was intended to provide the City with sufficient water supplies to get through at least a 1-in-50 drought without water restrictions for many years to come. Chapters 4 and 6 of this report review the progress in meeting this goal and evaluate the long-term prospects of maintaining this objective.

2.2.6 Regional Participation/Cooperation

The policy stated, "*The City should continue to work with the water suppliers throughout the Northern Colorado Front Range region to assure that adequate supplies are maintained in the region and that maximum use is obtained from supplies and available infrastructure (treatment capacity and transmission lines).*"

The City has continued to build a strong relationship with the water districts that serve water to customers inside the City and to surrounding areas. This is illustrated by an agreement that will allow the City and Tri-Districts (Fort Collins-Loveland, East Larimer County and North Weld County Water Districts) to exchange treated water for use in their respective systems. There is also an agreement in which several local entities are cooperating with the Northern Colorado Water Conservancy District (NCWCD) to construct and jointly use a new raw water transmission line from the Poudre River (Pleasant Valley Pipeline), which will be completed in 2004.

Other regional activities have included meeting with other users to understand the needs and dynamics of providing water supply along the Front Range. This has included such groups as the Larimer and Weld Water Issues Group, the technical advisory committee for the Metropolitan Water Supply Investigations and the Northern Regional Water Coalition. These groups have included a broad range of interested parties who are trying to protect the water resources in their respective regions.

As the City continues to grow, the adjacent water districts serve a larger proportion of new City residents. It is important to continue to work closely with the districts to insure that the level of water service is consistent throughout the City of Fort Collins.

2.2.7 Demand Management

The policy stated, "*Water conservation education programs should be continued and enhanced so as to encourage efficient water use. Plans should be made to provide adequate treatment plant capacity to meet projected peak day demands without imposing restrictions.*"

Following the adoption of the 1988 Water Supply Policy, two significant actions were taken to implement water conservation programs. In 1990, the City started installing water meters in existing single-family and duplex residences. The program began as a voluntary program and later changed to a mandatory program. The City completed metering all customers in the summer of 2003. Water use by these customer classes has been reduced by approximately 25%, primarily due to the metering program.

In 1992 the Water Demand Management Policy was adopted by City Council. A wide range of measures was considered prior to adoption. Twelve measures were identified which established the foundation for the City's water conservation program. A couple of the key measures include a leak detection program and a more aggressive public education program. Chapter 3 provides further discussion of the 1992 Water Demand Management Policy.

2.3 Policy Actions Implemented

Section 3 of Resolution 88-205 directed the Water Utility staff to implement several actions to meet the objectives of the water supply policies stated in the resolution. The following sections describe these actions and what has been done to meet them.

2.3.1 Increase Raw Water Requirements

The action stated, "*Increase the raw water requirements for new development by approximately 20%.*"

As mentioned in section 2.2.5, the requirements were raised 20% in 1989. Rate increases have enabled the City to obtain an adequate and diverse array of raw water supplies.

2.3.2 Purchase Additional Water

The action stated, "*Purchase 7,400 acre-feet of water over the next five years with funds generated from general water service fees.*"

The City purchased the 7,400 acre-feet of water in 1989 and 1990. Most of the water acquired was in the form of CBT units and NPIC shares. The 7,400 acre-feet purchased was in addition to water obtained through the raw water requirements satisfied by developers and builders.

2.3.3 Increase Water Service Fees

The action stated, "*Increase water service fees by 3% in 1989, 3% in 1990, and 2% in 1991 to finance the purchase of 7,400 acre-feet of water.*"

Water service fees were increased according to this schedule to fund the purchase of 7,400 acre-feet of water, thereby improving the reliability of the water supply for all Utility customers.

2.3.4 Improve Water Treatment Facilities

The action stated, "*Take steps necessary to optimize existing water treatment plant capacity and plan for future water treatment plant expansions that will meet projected demands without imposing restrictions.*"

Since the resolution was written, the water treatment facility has been expanded to handle up to 87 million gallons per day (MGD). This capacity should allow the City to meet its peak daily demand for the foreseeable future.

2.4 Summary

The 1988 Water Supply Policy (Resolution 88-205) provided the guidance to obtain a diverse array of water rights for at least a 1-in-50 drought situation. Efforts have been made to

cooperate with the agricultural community and other water providers in this area to beneficially use available supplies. The following chapters evaluate projected needs for the future and explain how the newly adopted Water Supply and Demand Management Policy will help meet these needs.

3.0 Review of 1992 Water Demand Management Policy

3.1 Background

In 1990, City Council formed a committee to explore issues of water demand management. The Water Demand Management Committee consisted of members of City Council, Water Board and Water Utility staff. As a result of the committee's work, City Council adopted the Water Demand Management Policy (Resolution 92-63) in 1992. A copy of the policy is included as Appendix B. The policy included five demand management policy elements, four goals and 12 measures. The policy elements, goals and measures are reviewed below.

3.2 Review of 1992 Policy Elements

3.2.1 Project a Water Conservation Ethic

The policy stated, "*The City should initiate and intensify activities that demonstrate a commitment to the efficient and wise use of water.*"

Since 1992, the City has taken numerous measures to encourage efficient use of water. Other City departments and customers are provided with information to help them carefully manage their water use. Many of the programs described below emphasize the City's commitment to water conservation.

3.2.2 Public Education

The policy stated, "*The community's awareness of the importance of using water efficiently should be reinforced and strengthened.*"

Although education has been the cornerstone of the City's water conservation program since 1977, new programs being added each year. Programs have been expanded for businesses, homeowners and students. Due to the recent drought (2000-2003) and the associated media attention, citizens have a heightened awareness of the importance of water and ways to use it wisely.

3.2.3 Defer Water Treatment Plant Expansion

The policy stated, "*Deferring expansion of the water treatment plant--without jeopardizing future needs--should be a goal of water demand management.*"

Although per capita water use has steadily declined, the Water Treatment Facilities Master Plan (1995) identified the need for additional capacity at the Water Treatment Facility. The largest improvement at the facility was completed in 2000 and increased the plant's capacity from 68 million gallons a day to 87 million gallons a day. The expansion was designed to optimize the treatment process and used some of the most advanced water treatment technology. In 2003, a backwash water recycling system was constructed at the facility that

will save approximately 5% of the total water treated annually by recycling the water used to clean the filters. No further expansion to the facility is anticipated at this time.

3.2.4 Permitting Compliance

The policy stated, "*Water use efficiency within the city should be improved in order to ensure compliance with anticipated federal and state permitting requirements for water use efficiency, applicable to future supply expansion projects.*"

Colorado House Bill 91-1154 required that larger water providers, including Fort Collins, implement a water conservation plan by 1995. After 1995, no state agency could consider a request for financial assistance to construct any water structure or facility unless the provider included a copy of their water conservation plan. The Colorado Water Conservation Board reviewed and accepted Fort Collins' water conservation plan as fulfilling all of the HB1154 requirements. In the event the City seeks financial assistance for a water project, the water conservation plan is on file.

3.2.5 Appearance of Landscaping

The policy stated, "*The attractive appearance of the community's public and private landscapes should be maintained and encouraged.*"

Explorers once called this area the Great American Desert, but early settlers found fertile ground. As the city grew and water became more available, citizens of Fort Collins began to take pride in the beauty of the community's landscaping. The demand management measures encourage conservation while still maintaining attractive landscaping. Although the city has seen some brown lawns in response to the recent drought (2000-2003), most citizens continue to value the community's attractive appearance.

3.3 Demand Management Goals

Resolution 92-63 included two goals to lower water use and two goals that help to meet the objectives stated in the resolution. The following sections describe these goals and what has been done to meet them.

3.3.1 City Leadership

The goal stated, "*Improve, document, and publicize the City government's water use efficiency, such that we can encourage the public through positive leadership.*"

The City strives to use water efficiently, such that we can encourage the public through setting a good example. One of the first tasks achieved after the policy was adopted was to meter all City-owned water taps so that water use could be tracked. When the City built the 215 North Mason building in 2001, water conservation was a priority. The building has state-of-the-art plumbing fixtures and Xeriscape landscaping. Parks, the City's largest water user,

tracks daily evapotranspiration rates to irrigate efficiently and has been replacing the grass in many of the medians with low water use plantings.

3.3.2 Reduce per Capita Peak Daily Demand

The goal stated, "*Lower the adjusted per capita daily demand from the current 605 gpc to 575 gpc by the year 1996 (5% reduction), 545 gpc by the year 2000 (10% reduction), and 502 gpc by the year 2010 (17% reduction).*"

Per capita peak daily demand is calculated by dividing peak day water use by the population served and is measured in gallons per capita (gpc). The base of 605 gpc referenced in the resolution was based on several years of historic use and adjusted to reflect weather conditions. It is statistically derived to represent a peak day that might occur once in 50 years. Because of the watering restrictions put in place for the recent drought years 2002 and 2003, the weather-adjusted peak daily demands were not calculated for those years. For 2001, the weather-adjusted peak daily demand was 503 gpc, a 16% reduction from the base.

3.3.3 Reduce per Capita Annual Consumption

The goal stated, "*Lower the adjusted per capita annual consumption from the current 235 gpcd to 223 gpcd by the year 1996 (5% reduction), 211 gpcd by the year 2000 (10% reduction), and 195 by the year 2010 (17% reduction).*"

Per capita annual consumption is calculated by dividing annual water use by the population served and 365 days (per year) and is measured in gallons per capita (or per person) per year (gpcd). The base of 235 gpcd is also adjusted for weather. Again, the annual consumption was not calculated in 2002 and 2003 due to restrictions. For 2001, the average demand was estimated to be 198 gpcd, a 16% reduction from the base.

Evaluating how much of the decrease in water use can be attributed to the 12 demand management measures is difficult as conservation practices are only one of several factors. Water use can vary for many reasons, including changes in weather, seasons, household size and income. The increase in the number of metered water accounts and the low-flow plumbing standards are two other factors that have helped to reduce per capita water use since the resolution's inception.

3.3.4 Annual Progress Report

The goal stated, "*Review progress in meeting goals and objectives on an annual basis, and make adjustments as necessary.*"

Beginning with a 1992 annual report, an update has been written each year to report the progress of implementing the demand management measures and reaching the water use goals. These reports have been distributed to City Council, the City Manager and Water Board.

3.4 Demand Management Measures

The 1992 Demand Management Policy set 12 measures for achieving the water use goals listed above. The following sections describe these measures and what has been done to meet them.

3.4.1 Implement an Ongoing Leak Detection Program

The measure stated, "*Implement an ongoing leak detection program.*"

The Utilities has long used state-of-the-art electronic leak detection equipment to pinpoint leaks in suspect locations of the distribution system. In 1993, the program was expanded by hiring two full-time employees to routinely "sweep" the entire distribution system for leaks within a three year period. Each year, miles of water main are surveyed for leaks so they can be repaired before they become surface leaks. This program saves the City water and money from reduced repair costs.

3.4.2 Audit and Reduce Indoor Water Use at City-Owned Facilities

The measure stated, "*Perform an audit of indoor water use at City-owned facilities, and install more water-efficient plumbing fixtures, where determined to be cost-effective.*"

An assessment of plumbing fixtures at City-owned facilities in 1995 concluded that the water savings would not justify the expense of retrofitting most fixtures. However, some retrofitting was done in areas that were cost-effective. One example of a water-saving retrofit is the showers at EPIC. Traditionally, the showers used a standard type of fixture allowing users to manually turn them on and off. Often the showers were left on, wasting water and energy. Retrofitted with a push-timer activated fixture, the showers now require users to start the timer every 15 seconds to keep it on.

The Energy Policy Act of 1992 set flow limits for plumbing fixtures, including 1.6 gallons per flush for toilets, 2.5 gallons per minute for showerheads, 2 gallons per minute for faucets and 1 gallon per flush for urinals. Low water-using plumbing fixtures are installed in newly built or remodeled City-owned facilities. Some public facilities have motion sensors on toilets and faucets. Reported leaks are repaired quickly at all facilities.

3.4.3 Meter All City Department Water Taps and Charge Appropriately

The measure stated, "*By the end of 1994, install meters on all City department water taps, and assess 100% of the associated water and wastewater service charges. Additionally, assess City departments that rent water at 100% of the current rental rate.*"

City water taps are metered, and departments are billed for the associated water and wastewater charges. To ease the burden on the City's General Fund, Parks and Recreation phased in payment of these charges. An additional $25,000 was appropriated each year until 2002, when all water and wastewater charges were covered.

The Utilities rents surplus raw water to area farmers and others at an established rental rate. Parks and Recreation rents raw water to irrigate some parks, golf courses and Grandview Cemetery. Rental fees for the raw water used at the golf courses and cemetery have been paid for in full since 1995. Parks began paying the current rate for raw water in 2001.

3.4.4 Enhance Public Education Campaign on Water Conservation

The measure stated, "*Institute a more aggressive, comprehensive and visible public education campaign on water conservation.*"

The Utilities has an active water conservation education program for all ages. On an ongoing basis, Utilities hears from customers requesting information about Xeriscape, lawn watering, water restrictions and other conservation topics. Commercial customers also contact Utilities for help in reducing their water bills and resolving billing questions. Conservation-related articles, brochures and other information are distributed at various City locations and through newspapers, newsletters and the Web.

The outreach program for residential customers emphasizes watering practices and Xeriscape because about half of a home's annual water use goes for outdoor watering. Programs are offered to the public as part of the City's environmental series and for organizations and schools; and exhibits are displayed at the libraries and other City buildings. Other activities include a sprinkler system audit program, a Xeriscape Demonstration Garden in front of City Hall and a seasonal daily lawn watering guide in the *Coloradoan.*

Due to the recent drought (2000-2003), conservation outreach increased with billboards, bus benches, bus panels, bus shelters and newspaper advertising in 2002 and 2003. An indoor conservation campaign challenged customers to save 5 gallons a day and offered free kits with a showerhead, faucet aerators and tablets to detect leaks in toilets. Outdoor water conservation kits, including a hose nozzle, moisture sensor and rain gauge, were given away during the summer of 2003.

Reaching youth is also an important component of the public education program. Utilities staff speak to elementary and junior high students about the history of water in Fort Collins and the West, water conservation, watershed studies, microbiology and water chemistry. Maps, videos, activity books and teacher's handbooks on a variety of water subjects are distributed to teachers for use during their study of water. Other events include an annual Children's Water Festival for third graders and Water School for seventh graders. In 2002, Dr. WaterWise introduced a new water conservation curriculum to elementary school students.

In addition, Utilities staff meets with targeted water users to help them look for ways to conserve. Some of the water user groups include landscapers, restaurants, hotels, motels, gyms, health clubs and key accounts. During the recent drought (2000-2003), tent cards with water conservation tips were distributed to restaurants, hotels and motels.

3.4.5 Convert City-Owned Landscapes to Raw Water Irrigation

The measure stated, "*Research all irrigated City-owned landscapes for the possibility of converting from potable to raw water, and implement where it is determined to be economically justified.*"

Currently, raw water is used to irrigate about 75% of the City's irrigated parks, medians, facilities, golf courses and cemeteries. The remaining 25% of irrigated land has been evaluated and either does not have access to raw water or is not cost-effective to convert at this time. The cost-effectiveness of converting the areas with access to raw water is evaluated on an ongoing basis.

3.4.6 Provide Training on Efficient Watering of City-Owned Landscapes

The measure stated, "*Provide an annual training program on efficient watering for all City employees and contract laborers that are involved with irrigation of City-owned landscapes.*"

Parks and Recreation staff manages the irrigation of the larger parks and contract with landscape maintenance contractors for small parks and medians. Irrigation scheduling and maintenance training are provided to City employees on an ongoing basis. City employees are also encouraged to pursue additional training through the Associated Landscape Contractors of Colorado and the Irrigation Association. Contractors are selected based on their irrigation management expertise.

3.4.7 Institute a Certification Program for Sprinkler Contractors

The measure stated, "*Institute a voluntary certification program for sprinkler contractors, with the qualification being the satisfactory completion of a test on water-efficient irrigation design.*"

The Irrigation Association and the Associated Landscape Contractors of Colorado offer excellent irrigation certification programs. There is no need for the City to duplicate these efforts with another program. A list of individuals who have these certifications is available upon request.

3.4.8 Amend the LDGS to Reward Water Conservation

The measure stated, "*Amend the residential and non-residential Point Charts within the Land Development Guidance System to include water-conserving actions in the awarding of points.*"

The Land Development Guidance System (LDGS) was amended to include landscaping standards for water conservation. Since 1992, the LDGS has been replaced by the Land Use Code, which also contains these landscaping standards. Utilities staff review landscape plans for new development for compliance with the water conservation standards. The plan review is part of the review process prior to City approval for new developments.

3.4.9 Develop Irrigation System Standards for City-Reviewed Projects

The measure stated, "*Develop minimum water conservation standards for irrigation systems associated with landscape plans for all development which is subject to City review and approval. This does not include the irrigation systems of single family residences.*"

The Land Use Code includes irrigation standards for water conservation. Utilities staff review irrigation plans and inspect irrigation systems for new developments to ensure they comply with the water conservation standards. The plan review is part of the construction permit review process, before a final building permit is issued.

3.4.10 Implement Central Irrigation Control for City-Owned Landscapes

The measure stated, "*Where determined to be financially justified for individual City departments, implement central irrigation control for irrigated City-owned landscaping.*"

Central irrigation control is a system whereby the irrigation of numerous, scattered sites can be controlled from a single central location. Parks and Recreation is the only City department with enough irrigated landscape to justify the cost of a central irrigation control system. In 1992, Parks and Recreation purchased a system, but the radio tower that worked with it is no longer operational. With the failure of that system, the plan shifted to installing individual central irrigation controllers in large, new parks.

3.4.11 Develop Guidelines for City-Owned Landscape Design

The measure stated, "*Develop guidelines for the design of City-owned landscaping, with a high priority being placed on water conservation and Xeriscape landscaping.*"

Landscaping standards for water conservation are written into the Land Use Code. City-owned property must comply with the same water conservation standards for landscape that are required of all new developments. Xeriscaping was installed at the remodeled Utility Service Center and the new City building at 215 Mason.

3.4.12 Develop a Zero-Interest Loan Program for Water Conservation Measures

The measure stated, "*Develop a zero-interest loan program for the installation of qualified water conservation measures, as specified by Water Utility Staff and Water Board.*"

Zero Interest Loans for Conservation Help (ZILCH) is a program that provides zero-interest loans for qualified residential water and energy conservation and air quality improvements. The program began in 1980 with a $50,000 federal grant for energy improvements. Since 1993, the Utilities has administered a zero-interest loan program to help customers replace water service lines, repair leaking pipes or plumbing fixtures or install ultra-low flush toilets. In early 2004, water-related loans were revised to only include high-efficiency clothes washers and service line repairs.

3.5 Summary

The 1992 Water Demand Management Policy (Resolution 92-63) gave focus to promoting water conservation among all City customers. Since the 1992 policy was adopted, the water use has come very close to meeting the intended 2010 target levels of the two water reduction goals. Efforts have been made to implement the 12 measures in the policy that help achieve the water use goals. The following chapters evaluate the City's demand management goals, explore the potential for further demand reduction, and explain how the newly adopted Water Supply and Demand Management Policy incorporates these issues.

4.0 Present Municipal Supply and Demand

4.1 Water Demand

For many years, the City has maintained a system of obtaining water rights sufficient to meet the needs of new growth and provide a reliable supply for all customers. A study in 1985 defined the effects of prolonged droughts on the City's water supply system and was an important factor in the development of the 1988 Water Supply Policy. In addition, the 1992 Water Demand Management Policy has helped the City to reduce its demands.

4.1.1 Historic Trends

Annual water demand tends to increase in proportion to population. Several factors, however, cause the demands to vary from year to year. The primary factor that affects variation in demand is the weather. Water demands for the City's municipal customers can vary by up to about 10% above or below average use, depending on whether it is a wet year or a dry year. Other factors that can affect the average water use per person over the long term are changes in water use characteristics, conservation and education programs, changes in development density, leakage in the distribution system, industrial/commercial growth and changes in plumbing fixtures.

Table 4-1 shows how the City's treated water use has changed since 1960.

Table 4-1
Historic Treated Water Demand for Utility Service Area (1960-2000)

Year	Service Area Population (1000)	Measured Treated Water Use (Ac-ft)	Estimated Supply Needed for Treatment in Average Year[(1)] (Ac-ft)
1960	27.5	8,590	7,277
1965	38.2	8,446	10,109
1970	48.4	11,257	12,808
1975	60.4	15,186	15,984
1980	73.7	17,339	19,504
1985	85.0	20,424	22,494
1990	95.9	28,508	29,316
1995	106.2	24,763	30,168
2000	118.3	31,594	31,760

Notes:
1. Based on 225 gpcd for 1960-1990, 210 gpcd for 1995, and 198 gpcd for 2000; plus large contractual use of 3,750 ac-ft for 1990 and 1995, and 4,010 ac-ft for 2000. Also, it is assumed that an additional 5% of treated water use was needed to process the treated water.

From 1990 to 2000 the Water Utility service area population increased almost 25% while the total treated water use increased only about 10%. This is largely due to the installation of meters in the majority of single family homes during this period. As a group, single family

homes have reduced their use by an average of about 25% per home. Excluding large contractual water use, the per capita treated water use for an average year is currently less than 200 gallons per person per day for the service area. Other reasons for the water demand reductions include an extensive leak detection program, on-going water conservation education and awareness, federal low-flow plumbing standards for new construction and weather related variables.

The Water Utility currently delivers an average of approximately 31,000 acre-feet per year to its treated water customers. Raw water (untreated) is used in addition to treated water to irrigate many areas in the City. Approximately 3,000 to 4,000 acre-feet is used to irrigate City parks, golf courses, a cemetery, greenbelt areas and some school grounds. In addition to these demands, the City has raw water delivery obligations of approximately 4,000 acre-feet per year.

Municipal water use is often gauged by daily per person use, measured in gallons per capita per day (gpcd). This is calculated as total treated water use (including residential, commercial, etc.) divided by service area population for the Utility and 365 days (per year). It should be noted that these calculations are adjusted for large contractual customers and other sales or exchange arrangements to produce a value that is comparable to other municipalities. Around 10 to 12 years ago, the City's demand rate was about 235 gpcd. In 2001, before water restrictions in drought years 2002 and 2003, the demand rate had dropped to 198 gpcd. The main reason for the decline was the installation of water meters in existing homes, which was completed in the summer of 2003. The 198 gpcd demand rate is close to the 1992 Water Demand Management Policy target of 195 gpcd by 2010.

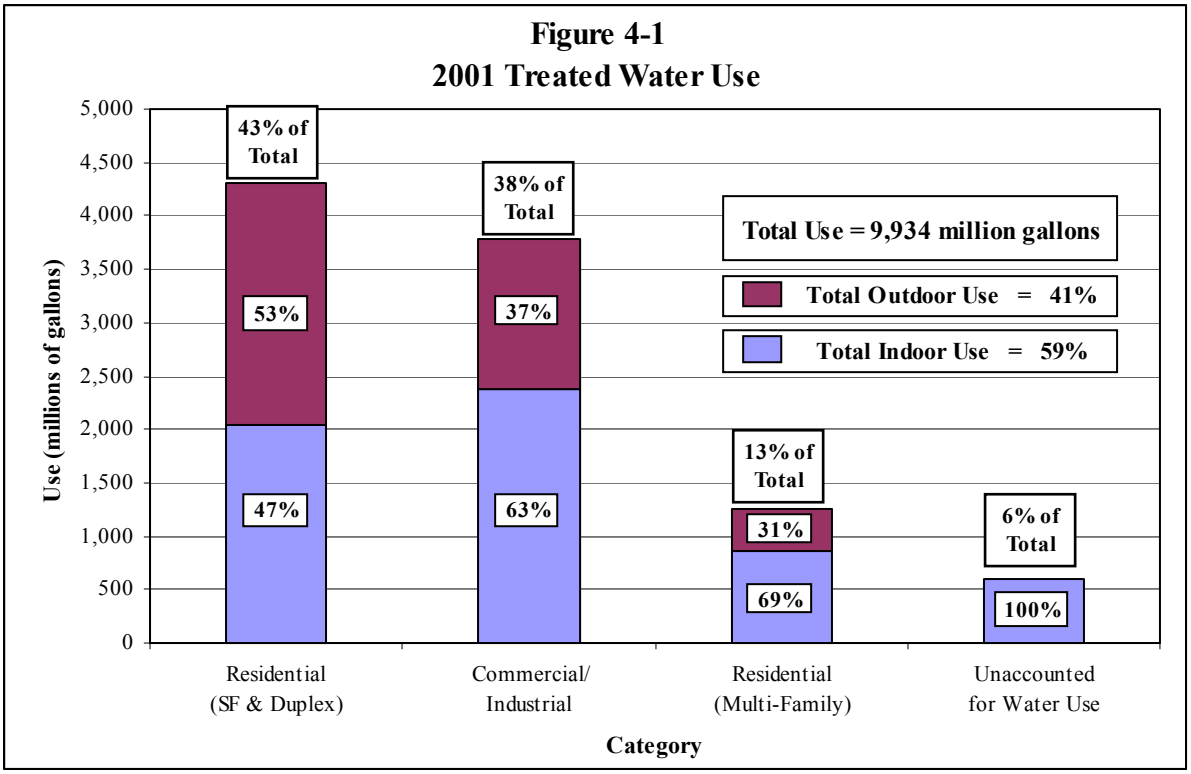
4.1.2 Analysis by Customer Groups

The year 2001 was an average year for the City in terms of weather conditions and water use. Figure 4-1 illustrates the treated water use for 2001 and shows the breakdown of use by different customer categories as well as by indoor and outdoor water use.

100 Homes Study

A study of 100 single-family residences was performed to analyze use trends among this customer class. The study homes were randomly selected from the City's single-family metered accounts that had listed lot sizes and water use data for all 12 months of 2001. Since there are many single-family residential accounts that are not used during some months due to vacancies, the water use values in this study are somewhat higher when compared to average single-family use. To remove outliers that may have skewed the results of the study, approximately 3% of the smaller lot sizes and/or water users and 3% of the larger lot sizes and/or water users were not selected for the study. Landscaped and impervious areas were measured for each of the 100 homes using the City's GIS aerial photograph database. Impervious areas included the house footprint and driveway, as well as any other large impervious areas (e.g., detached garage, shed, etc.). Landscape areas were simply calculated as the remainder of the lot minus the impervious area. It should be noted that the total lot size measured with GIS, termed the "effective lot size", included areas that are probably irrigated

and may be larger than the lot size recorded in Larimer County records. Some randomly selected lots were not used in the study because of difficulty in distinguishing landscape and impervious areas with the GIS images.



Once the 100 homes were selected and landscape and impervious areas measured, water use data for 2001 was gathered to assess data such as total water use, indoor and outdoor use, and irrigation application depth. Indoor water use was calculated using the winter quarter average (average billed use in January, February and March) and multiplying by 12 months for the total indoor use for the year. Outdoor water use was then calculated by subtracting the indoor use from the total water use. Irrigation application depth is calculated by dividing the outdoor water use by the landscape area for each lot and converting for inches of water. This method of calculating application depth assumes that all of the landscape (non-impervious) area is irrigated, which may not be the case for all homes.

Table 4-2 shows results from the 100 Homes Study. The results split the 100 homes into five groups based on the age of the house to show trends among different home ages. Figure 4-2 illustrates outdoor water use trends among the 100 homes studied.

As shown in Table 4-2, newer homes are using more water annually than older homes, most of it outdoors. Effective lot size and percent of lot landscaped appears to be decreasing for newer homes. The most notable result is that newer homes are applying considerably more water to their landscapes than older homes.

Table 4-2
100 Homes Study Results

Period of Homes Studied	# of Homes in Period	Average Total Use (gal)	Average Indoor Use (gal)	Average Outdoor Use (gal)	Average Effective Lot Size	Average % of Lot Irrigable	Average Appl Depth (inches)
1910-1963	18	129,550	48,767	80,783	9,125	67%	20.6
1964-1976	20	142,973	71,706	71,267	9,638	64%	19.1
1977-1983	22	143,514	65,000	78,514	9,119	68%	19.6
1984-1992	20	155,092	74,476	80,616	8,180	66%	24.3
1993-1997	20	159,955	63,340	96,615	8,320	58%	31.9
	Averages:	146,496	64,982	81,514	8,876	65%	23.1

Figure 4-2
100 Homes Study: Irrigation Application vs. Requirements

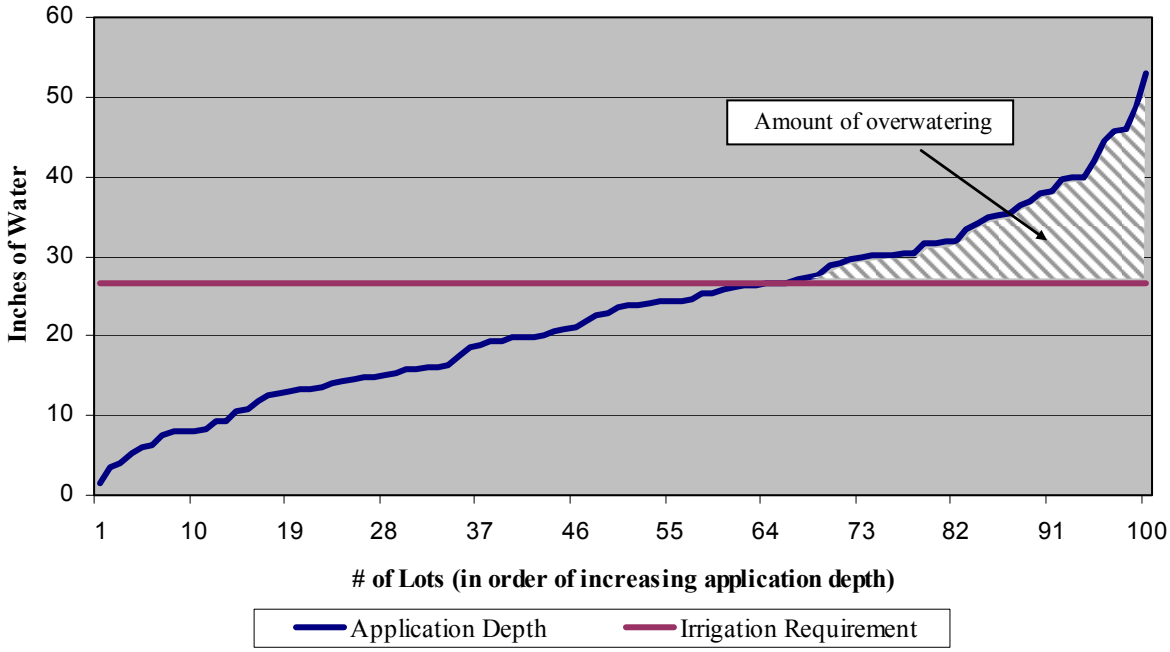


Figure 4-2 illustrates the 2001 outdoor water use among the 100 homes studied and compares that use to irrigation requirements for that year. The outdoor use for the 100 homes was plotted in order of increasing application depth (dark line in figure). The irrigation requirement (straight line in figure) is the amount of water the landscape would need in inches assuming a cool-season turf grass. For this study, irrigation requirement is calculated as evapotranspiration (for unshaded cool-season turf grass) minus precipitation for the period of April 1 through October 31, 2001, which was around 26.5 inches of water. Approximately 65% of the homes used less than the irrigation requirements. This may be due to the fact that many of the yards are shaded and may have landscaped areas that are not turf grass and require less water. Of the nearly 35% of homes that had water use in excess of the irrigation requirement, 60% were built after 1983. This may be due to the fact that newer homes typically lack the shade that reduces irrigation requirements. Also, newer homes frequently

have automatic sprinkler systems. If not used properly, these systems can overuse water by not adjusting to weather changes such as rainfall events or cooler periods. Overall, the amount of overwatering for these 100 homes and irrigation requirements is around 12% of their total outdoor water use.

4.1.3 Potential Water Savings

By reviewing the City's current water use, the potential for saving water can be determined. Water savings can occur both indoors and outdoors. Most of the assumptions made for water savings are based on the 100 Homes Study.

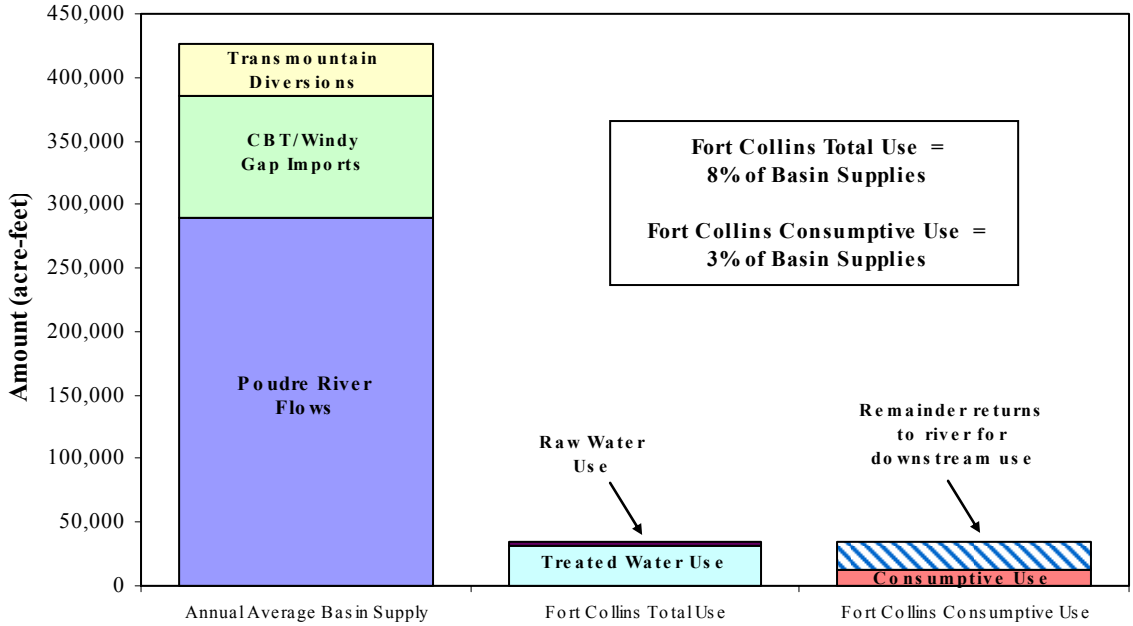
The basic means of reducing indoor water use include educating the public to use water efficiently in their homes and businesses, replacing older plumbing fixtures with newer low-flow fixtures, and trying to assess commercial and industrial water users for ways to reduce their indoor use. Around 80% of the homes in the 100 Homes Study were built prior to 1992, when federal plumbing standards resulted in low-flow fixtures being installed in all new homes. It is estimated that with a conversion from the older plumbing fixtures to the low-flow fixtures, the City could save around 5% to 10% on indoor water use, which equates to a 3% to 6% overall savings in total water use.

As shown in Figure 4-2, outdoor water use is in excess of landscape needs for many of the homes studied. It stands to reason that water users within other groups (such as multi-family, commercial, etc.) are also over watering their landscapes. Based on the assumptions mentioned previously, the amount of overwatering in the 100 Homes Study is around 12% of their total outdoor water use. Since it may be difficult to get all the users that are overwatering to reduce their use, a reasonable estimate of anticipated savings could be 5% to 10% on outdoor water use. This would equate to a 2% to 4% overall savings in total water use. If both indoor and outdoor potential water savings are added, the City could reasonably expect to see a 5% to 10% overall savings in total water use by reducing water waste.

4.1.4 Fort Collins Use Compared to Poudre River Basin Supplies

Figure 4-3 shows the City's water use compared to the Poudre River Basin supplies. This graph illustrates that the City uses a relatively small percentage of the water in the basin. Total basin supplies average around 425,000 acre-feet annually and include Poudre River flows, Colorado-Big Thompson Project and Windy Gap Project imports from the west slope, and other transmountain diversions (such as the Michigan Ditch). In comparison, the City's current water use is only around 31,000 acre-feet of treated water annually and around 3,000 acre-feet of raw water annually. The total City use is only about 8% of the total basin supplies. Around 65% of the water used by the City returns to the river through wastewater treatment effluent and some surface and ground water return flows. The City's amount of consumptive use (water used that does not return to the river) is only around 3% of the total basin supplies.

Figure 4-3
City Water Use vs. Poudre River Basin Supplies

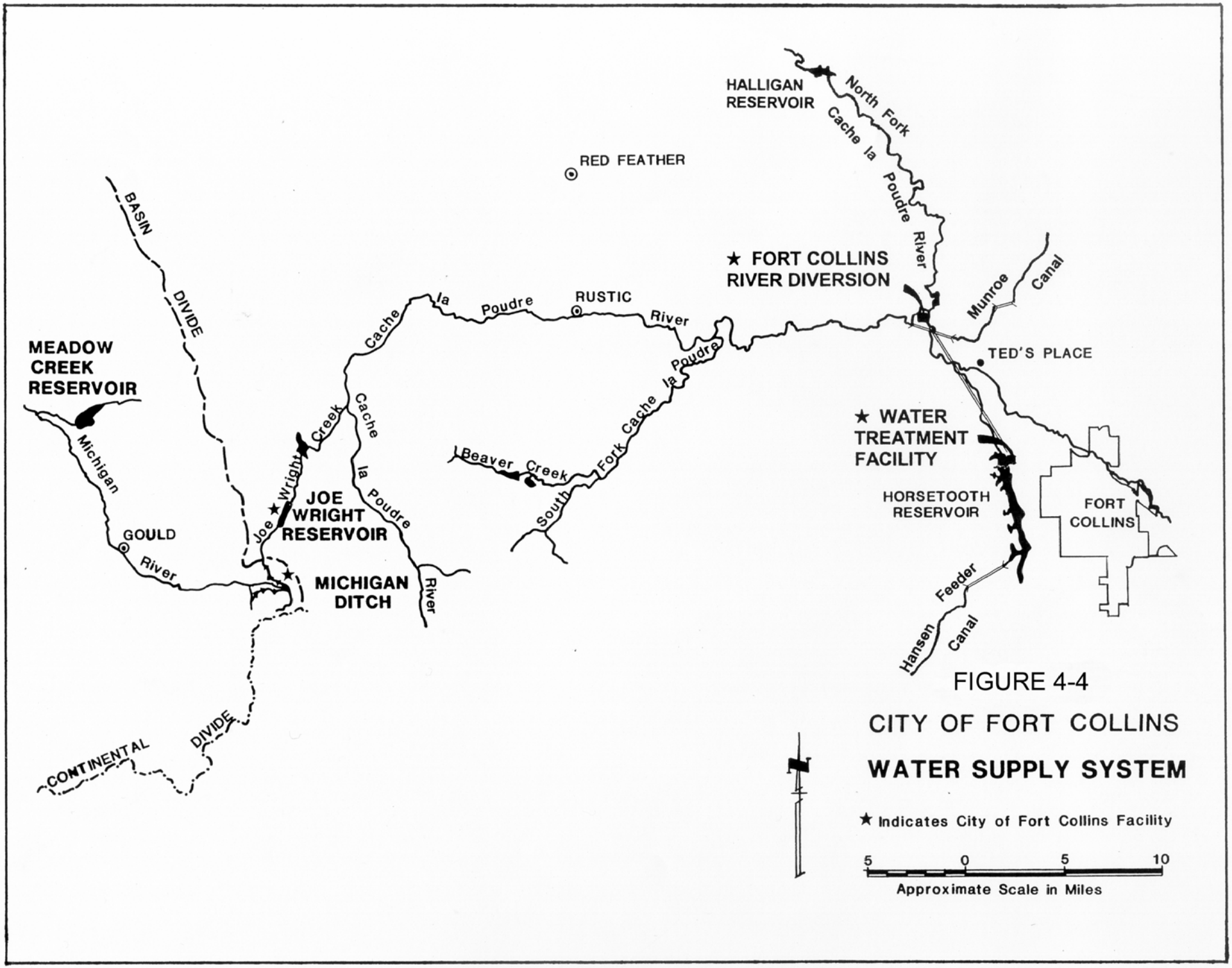


4.2 Water Supply

Over the last 40 years, the City has obtained a wide variety of water rights for use by its customers. The City's water comes from either the Poudre River Basin or from the Colorado-Big Thompson (CBT) Project (which includes Horsetooth Reservoir). Figure 4-4 shows the location of some of the City's key facilities related to delivering water from these sources. These facilities include the diversion structure and pipeline off the Poudre River, Joe Wright Reservoir, Michigan Ditch and the water treatment facility. Also shown are Horsetooth Reservoir and Halligan Reservoir operated by the Northern Colorado Water Conservancy District (NCWCD) and North Poudre Irrigation Company (NPIC), respectively. The following sections describe the various sources that make up the primary supplies available to the City.

4.2.1 Sources Available from the Poudre River

The following sources are generally available for diversion from the Poudre River. The City currently diverts its Poudre River flows to the water treatment plant through a pipeline located on the mainstem of the river, just above its confluence with the North Fork of the Poudre River. The City will be able to use its portion of the Pleasant Valley Pipeline in the spring of 2004. To avoid confusion when discussing Poudre River diversions, the City's older pipeline and the new Pleasant Valley Pipeline (PVP) will be referred to as the original pipeline and the new PVP, respectively. Further discussion of the new PVP is included in Section 6.2.2.


HALLIGAN RESERVOIR
North Fork Cache la Poudre River
RED FEATHER
BASIN DIVIDE
★ FORT COLLINS RIVER DIVERSION
Munroe Canal
Cache la Poudre River
RUSTIC
TED'S PLACE
MEADOW CREEK RESERVOIR
Michigan
Joe Wright Creek
Cache la Poudre River
South Fork Cache la Poudre River
Beaver Creek
★ WATER TREATMENT FACILITY
HORSETOOTH RESERVOIR
FORT COLLINS
★ JOE WRIGHT RESERVOIR
GOULD
River
MICHIGAN DITCH
Feeder Canal
Hansen
CONTINENTAL DIVIDE
FIGURE 4-4
CITY OF FORT COLLINS
WATER SUPPLY SYSTEM
★ Indicates City of Fort Collins Facility
5 0 5 10
Approximate Scale in Miles

Senior Direct Flow Decrees. The City has five senior direct flow decrees on the Poudre River that allow the City to take 19.93 cfs (12.88 MGD) from April 15 through October 15 and 15.00 cfs (9.70 MGD) from October 16 through April 14. These water rights are diverted into the City's original pipeline. Since these are very senior decrees on the Poudre River, they are available to the City most of the time. In very severe dry periods, diversions may be limited to approximately 10,400 acre-feet per year. In average and wet years these water rights have the potential to yield about 12,600 acre-feet per year.

Junior Direct Flow Decrees. These decrees (1955 appropriation date) allow the City to take an additional 12.54 cfs (8.11 MGD) from April 15 through October 15 and 17.47 cfs (11.29 MGD) from October 16 through April 14 at the existing pipeline. These rights, along with the above senior rights, allow a total diversion of 32.47 cfs (20.99 MGD), which is the capacity of the original pipeline. These junior rights, however, are only in priority during the peak runoff period when most of the other rights on the Poudre River have been satisfied. In dry years, the City may not be able to divert anything under these rights. In average to wet years, the City may be able to divert up to 12.54 cfs (8.11 MGD) for up to about one month during the peak runoff. The annual yield could range from zero to about 750 acre-feet per year.

Pleasant Valley and Lake Canal (PVLC) Shares. The City of Fort Collins owns about 70% of the shares in this mutual irrigation company. A change of use granted in Water Court Case No. 80-CW-193 in the early 1980s allows the City to take its pro rata share of water from the Poudre River for municipal purposes. The amount of water the City is entitled to divert to meet treated water demands depends on the number of shares the City designates for such use and which priorities owned by the irrigation company are in priority during the season. Under present ownership, the potential annual yields from this source range from 4,000 acre-feet to 7,500 acre-feet.

Southside Ditches (SSD). The City owns shares of stock in the Arthur, Larimer No. 2, New Mercer and Warren Lake irrigation companies, often referred to as the Southside Ditches. A change of use from agricultural to municipal was granted in Water Court Case No. 92CW129 making diversions possible from the Poudre River for treated water use. These diversions can be made under 13 separate priorities and the yields vary considerably from year to year. Much of the yield comes from a couple of large junior rights and therefore normally occurs during the month of June. Under present ownership, the potential annual yields from this source range from 3,000 acre-feet to 8,000 acre-feet. Most of the water from these water rights can be diverted into the City's portion of the new PVP.

Michigan Ditch and Joe Wright Reservoir System. This system consists of a ditch that diverts water from the Michigan River drainage across the divide into the Poudre River Basin, Joe Wright Reservoir located high in the Poudre River Basin and storage capacity in Meadow Creek Reservoir located in the Michigan River Basin. Joe Wright Reservoir, which includes about 6,500 acre-feet of active storage and is the only storage facility owned by the City, can store Michigan Ditch diversions and water from Joe Wright Creek. This mostly reusable water is part of the Reuse Plan (see section 1.2) that requires delivery of specified quantities of water during the year. To the extent this water can be stored in the reservoir, the time of use is more flexible than the direct flow sources listed above. However, there are usually periods

during the peak runoff season in which the reservoir is full and Michigan Ditch water is available if it can be taken directly to meet demands. The City also has rights to 1,200 acre-feet of storage capacity in Meadow Creek Reservoir, which is used to release water to downstream senior rights on the Michigan River in order to increase the City's Michigan Ditch diversions. It should be noted that Joe Wright Reservoir is used primarily to regulate the annual Michigan Ditch flows to help meet the Reuse Plan and has a limited amount of carryover capacity to provide drought protection for the City. The potential annual yield from this system ranges from about 4,000 acre-feet to 10,000 acre-feet.

Water Supply and Storage Company Shares. The City owns about 26 shares in this irrigation company. Since the City-owned shares are not presently decreed for municipal use, this water is usually rented back for agricultural use. The yield from these shares for agricultural use is approximately 2,200 acre-feet per year.

During the last 40 years, the City has obtained shares of several local irrigation company stocks. These have been primarily turned over to the City by developers to satisfy the City's raw water requirements. Table 4-3 shows how many shares and the percentage ownership for each of the irrigation companies as well as for ownership of CBT Project units.

Table 4-3
Shares Owned in Local Irrigation Companies (as of December 2003)

Company/District	Shares Owned by City	Total Shares in Company	Percent Ownership by City	Conversion Factor (Ac-ft/Sh)	Average Yield (Ac-ft/Yr)
Arthur Irrigation Co.	483.04	1,207	40.0%	3.44	1,662
Larimer County Canal No. 2	90.01	146	61.7%	42.69	3,843
NCWCD (CBT)	18,855.00	310,000	6.1%	0.76	14,330
New Mercer Ditch Co.	63.97	141	45.4%	30.23	1,934
North Poudre Irrigation Co.	3,552.75	10,000	35.5%	5.57	19,789
Pleasant Valley & Lake Canal Co.	179.47	255	70.4%	39.74	7,132
Warren Lake Reservoir Co.	117.08	225	52.0%	10.00	1,171
Water Supply & Storage Co.	26.42	600	4.4%	84.00	2,219
Miscellaneous	-	-	-	-	1,140
Total					53,219

Notes:
1. Yields are the approximate average annual yields of the water rights and do not reflect weather variations and other physical and legal constraints in the system.

4.2.2 Sources Available from Horsetooth Reservoir

The following sources are available for use out of Horsetooth Reservoir, which is a part of the CBT Project. This water can be delivered to the City's water treatment facility just below Soldier Canyon Dam or be released from Horsetooth Reservoir to the Poudre River where it can be delivered or exchanged to various points of diversion on the river. Although the CBT

project includes a large amount of storage, including Horsetooth Reservoir, the City has a limited ability to carry over water in CBT reservoirs for drought protection. Currently, the NCWCD allows a 20% carryover allowance for CBT shareholders, which can only be CBT project water (as opposed to the excess Poudre River water). However, as the certainty of this carryover allowance is questionable, it has not been factored into future use.

Colorado-Big Thompson (CBT) Water. The City presently owns about 18,850 units of CBT water. Deliveries depend on the annual "quota" set by NCWCD each year. With annual quotas ranging from 50% to 100%, the annual yields range from about 9,400 acre-feet to 18,800 acre-feet. For the most part, this water is the most flexible source that the City owns and can be used to fill gaps from other sources. Part of this water, however, needs to be used at designated times to meet exchange requirements of the Reuse Plan and to meet other contractual obligations.

Windy Gap Water. The City annually receives 4,200 acre-feet of Windy Gap water from Platte River Power Authority (PRPA) as payment for 4,200 acre-feet of reusable effluent made available to PRPA by the City. Windy Gap water was developed by the Municipal Subdistrict of the NCWCD and is delivered through the CBT system. The reusable effluent is the result of the Reuse Plan (see section 1.2) that involves the City, PRPA, and the Water Supply and Storage Company (WSSC). The 4,200 acre-feet of Windy Gap water is dedicated for large contractual use that requires reusable water. The demands from the contractual use are relatively constant over the year and need to be met with the Windy Gap water out of Horsetooth Reservoir. As part of the Reuse Plan, the City is required to deliver 1,890 acre-feet of single use water to the WSSC.

North Poudre Irrigation Company (NPIC) Shares. The City currently owns about 3,550 shares of NPIC. Each share consists of native water supply (which is primarily decreed for agricultural use) and 4 units of CBT water. The total annual yield per share varies from about 3.5 acre-feet to 7.0 acre-feet. However, until the agricultural portion of each share is changed for municipal purposes, the City can only use the CBT portion of the shares to meet treated water demands. Based on the CBT portion of each share, the City's annual yield presently ranges from about 7,000 acre-feet to 14,000 acre-feet.

West Fort Collins Water District (WFCWD) Water. Through an agreement with the WFCWD, the City provides treated water to their customers and in return, gets reimbursed with an equivalent amount of CBT water. In recent years, the amount transferred to the City has been about 600 acre-feet each year. The Utility's population and water use estimates include the WFCWD.

The CBT water and part of the NPIC water provide the most flexible water supplies since they are available in Horsetooth Reservoir where they can be stored until needed to meet demands. If the water from these sources is in excess of the current year City demands, they can usually be leased out for agricultural use in the area. Because of this, in most years it is desirable to use other sources to meet City demands prior to using the CBT and NPIC supplies.

The City of Fort Collins has a policy of acquiring and maintaining a water supply that is sufficient to meet or exceed the demands during a severe drought that would occur with a frequency of only once during a 50 year period. The City owns water rights that average over 70,000 acre-feet per year if they were fully usable; however, because of various legal and capacity constraints the present yield available for municipal use is much less. The City's water rights are estimated to be worth over $700 million. The average yield of supplies that the City owned over the 1960 - 2000 period is illustrated in Table 4-4 and Figure 4-5. The yield available to meet treated water demands during the 1-in-50 drought period is approximately 35,000 acre-feet per year.

4.3 Firm Yield Concept

The yield from the City's supply sources varies considerably from year to year. Because of this, demands cannot easily be compared to the average annual supply yields. Instead, it is necessary to make an analysis of how the supplies and demands compare during a series of critically dry (or drought) years. A concept often referred to as "firm yield" is used by many entities to measure the ability of their water supply system to meet water demands through a series of drought years.

Firm yield is commonly determined by calculating the maximum constant base demand that can be met with the available supply during a representative hydrologic period. For this determination, it is assumed that both the demand contributors (population, irrigated acres, etc.) and the supply owned (storage capacity, water rights, shares of stock, etc.) are held constant during each trial run of the hydrologic study period. This procedure results in a firm yield or safe average annual demand (SAAD) that can be met with the current supply system. Once this is determined, one can compare the present average annual demand with the firm yield to determine the margin of safety or reserve supply.

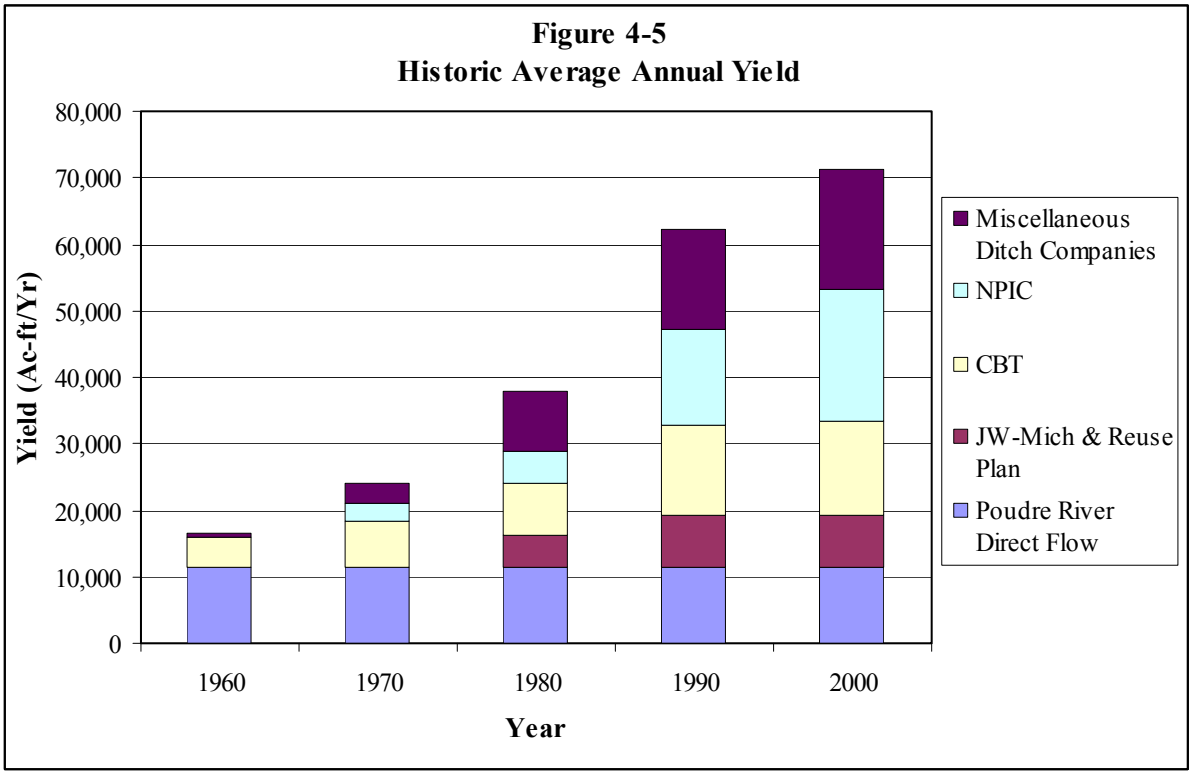
The issue that often comes up in discussions about firm yield is whether the representative hydrologic study period contains the type of drought for which protection is desired. Many entities simply take a recent 20 or 30 year historic period and assume that if they can make it through any droughts contained in that period, their supply is adequate. Without knowing something about the severity of the drought in a historical period, the use of such a period may not be adequate. The Fort Collins "Drought Study", completed in 1985, was done primarily to study the effects of prolonged droughts and to define them in terms of the probability of their occurrence. In the 1985 Drought Study, synthetic hydrologic traces were produced based on statistical parameters of the historic data available. This allowed analysis of numerous artificial drought periods and a determination of representative droughts with calculated return frequencies. Once this was determined, a computer model was used to determine the SAAD that could be met for each drought type. More discussion regarding drought analysis is included in the following chapters.

Table 4-4
Historic Average Annual Yield

Source	Conversion Factor (Ac-ft/Sh)	Average Annual Yield (Ac-ft/Yr) 1960	1970	1980	1990	2000
Poudre River Direct Flow		11,300	11,300	11,300	11,300	11,300
Joe Wright-Michigan Ditch		0	0	4,800	5,500	5,500
Reuse Plan (PRPA)		0	0	0	2,300	2,300
NCWCD (CBT)	0.76	4,600	7,000	8,000	13,600	14,300
N. Poudre Irrigation Co.	5.57	0	2,800	4,700	14,600	19,800
Arthur Irrigation Co.	3.44	0	400	400	1,300	1,500
Larimer County Canal No. 2	42.69	200	300	1,600	2,700	3,500
New Mercer Ditch Co.	30.23	300	300	500	1,300	1,800
Pleasant Valley & Lake	39.74	200	1,800	4,500	6,300	7,000
Warren Lake Reservoir Co.	10.00	0	100	400	800	1,000
Water Supply & Storage Co.	84.00	0	0	1,400	1,900	2,200
Miscellaneous		0	0	200	700	1,200
Total		16,600	24,000	37,800	62,300	71,400

Notes:
1. Yields are the approximate average annual yields of the water rights and do not reflect weather variations and other physical and legal constraints in the system.

Figure 4-5
Historic Average Annual Yield



4.4 Raw Water Requirements

When new development occurs within the current Utility service area, developers are assessed a raw water requirement (RWR). This practice originally began in the 1960s when two acre-feet per acre of land developed was required. In the early 1970s this was changed to three acre-feet per acre. Because water use varied considerably depending on the type of use for any given area, a study was done in 1983-84 to develop another method of assessing the raw water requirements. The resulting system, still in use, attempts to more closely assess the requirements based on actual use.

For residential development, a formula was adopted that considers the density of residential development. Water use is estimated by considering both indoor and outdoor use. The RWR is calculated by multiplying the water use estimate by a "water supply factor" that is used to reflect the variability in supply and demand from year to year as well as other unaccounted for water use. The equation presently used to determine the residential RWR is as follows:

$$RWR = 1.92 \times ((.18 \times \text{Number of Dwelling Units}) + (1.2 \times \text{Net Acres}))$$

The water supply factor was originally set at 1.6; however, following the adoption of the 1988 Water Supply Policy, the water supply factor was increased by 20% to 1.92.

Non-residential requirements are based on tap size. Water use was analyzed for all non-residential customers for a given tap size and the requirements were based on those results. Since there is a lot of variability within each tap size, a raw water surcharge is assessed for any annual use exceeding an annual allotment. Requirements vary from .90 acre-feet for a 3/4 inch meter to 14.40 acre-feet for a 3 inch meter. If the water tap is above the 3 inch size, the RWR is based on an estimate of water use.

Developers and builders may satisfy the raw water requirements by turning over water rights acceptable to the City or paying cash in-lieu-of the water rights. Cash in-lieu-of payments can be used to purchase additional water rights when appropriate or acquire other means of increasing the City's water supply, such as developing storage capacity. The cash fee has been periodically adjusted over the years to reflect the price of water rights on the market.

4.5 Colorado Water Law Considerations

Water in Colorado is a limited renewable resource. Early settlers adopted a series of water laws that guarantee security, assure reliability, and create flexibility in the development and protection of water resources. This section briefly explains some of the basics of Colorado water law.

The Colorado Doctrine, defined in Article 16 of the Colorado constitution (1876), is a set of laws regarding water use and land ownership that have been used since the 1860s. The doctrine defines four principals of Colorado water law. First, all surface and ground water in Colorado is a public resource for beneficial use by individuals, public agencies or corporations. Second, a water right is a right to use a portion of the public's water resources.

Third, water rights owners may build facilities on the lands of others to move water to its place of use. And fourth, water rights owners may use streams and aquifers for the transportation and storage of water.

Another important component of Colorado water law is the "prior appropriation" system. This system dictates that the use of water must be beneficial or a right will not be granted by the State. The priority system dictates that in times of short supply, earlier water rights decrees (senior rights) will get their water before others (junior rights) can begin to use water, often described as "first in time, first in right". Water rights owners must continue to use their water beneficially or risk losing their right, coining the term "use it or lose it". The change, sale or transfer of a water right can occur without losing its priority date if it maintains the same use in time and quantity and prevents injury to other water rights. This later item is especially important to the City when transferring its agricultural water rights to municipal use.

Occasionally, the water rights acquired by the City through its raw water requirements or other means must be transferred from agricultural to municipal use in order to allow the City to treat those waters for its use. This process requires obtaining a decree from Colorado Water Court that states its legality and typically involves detailed analysis of the historic water use. For example, in 1996 the City obtained a decree to use its Southside Ditches (SSD), which includes the Arthur Ditch, Larimer No. 2 Canal and New Mercer Canal water rights owned by the City. The court required the City to show that historic return flow patterns and diversion limitations were met. This process was designed to show that the City would not take more water than had historically been taken when the water rights were used agriculturally, thereby preventing injury to other water rights.

5.0 General Policy Objectives

The City's recent policy update will help guide the Utilities in planning for the future. This policy provides a sustainable and integrated approach to providing an adequate and reliable supply of water for the beneficial use by customers and the community while managing the level of demand and the efficient use of a scarce and valuable resource. The following sections describe other general objectives of the updated policy.

5.1 Water Conservation

Water conservation, or demand management, is an effective way to extend a water supply. Water conservation includes activities that reduce the demand for water, improve the efficiency in use, and reduce unaccounted for and unnecessary water use. In general, reduced demands may decrease the amount of or prevent the need for additional water supply systems, such as additional pipelines and storage capacity. However, there are limits to the amount of demand reduction. Reducing demands excessively could make the City vulnerable to droughts that exceed (or are more severe than) the 1-in-50 drought criteria and could also affect the economic viability of the City. Elements of the new Water Supply and Demand Management Policy will help the City achieve the policy goal of reducing demands to a reasonable level.

5.1.1 Reduce Unnecessary Water Use

Homes and businesses use water in many ways, for indoor and outdoor purposes. Water conservation includes efforts to reduce unnecessary water use. Outdoor water use is most often associated with overuse as evidenced by water running off lawns onto the street or pooling in a gutter. Unnecessary water use can be decreased through education, like sprinkler system audits that teach wise watering practices; or through wasting water regulations. Outreach to customers also emphasizes habits that can save water indoors, such as turning off the tap while brushing teeth or shaving. Excessive water use is often the result of ignorance, not intention. Education can be effective in changing habits that save water without a drastic change in lifestyle.

5.1.2 Reduce System Costs

There are many costs associated with developing a water supply system, including costs for water rights acquisition, raw water collection, treatment and distribution facilities, environmental and agricultural impacts, and legal issues. Reducing water demands will help reduce these costs for several different reasons. First, reduced demands will decrease the need for additional facilities such as reservoirs and pipelines, which may also reduce associated environmental mitigation costs. Although the City's water treatment plant has been built to handle the peak daily demand of the City's projected build out, reduced demands could benefit the treatment plant by potentially reducing chemical costs and other operating expenses.

5.1.3 Promote Conservation Ethic

The success of the City's water conservation program depends on the cooperation of its customers. Instilling a conservation ethic is an important first step to changing habits and attitudes toward water use. The importance of water conservation must be understood before most people will change behaviors. The City continues to promote a conservation ethic through its actions and conservation programs.

5.2 Water Supply

As the City continues to grow, so will its water demands. Although some of the future water needs can be met by reducing demands, the City will still need to acquire additional water supplies and other facilities that enhance the flexibility and reliability of the City's supply system. Elements of the recent policy update will help the City to achieve the policy goal of providing an adequate and reliable supply of water.

5.2.1 Provide Adequate Supplies

One of the main functions of the Utility is to provide an adequate supply of water to meet customer needs. The need for water in Fort Collins includes public health and safety, landscaping and environmental enhancements, comfort and recreation, and growth and economic output. These needs apply to all customers, including residential, commercial, industrial and governmental. Indoor water use includes drinking, cleaning, cooking, waste removal and industrial processes. Outdoor water use includes washing, recreation and landscape irrigation. Providing adequate supplies to meet these needs is defined by the quantity of water necessary to provide the desired benefits, the efficiency of the use of the water, and the reliability and flexibility of the supply system. The updated policy is geared towards providing supplies that can meet all the needs of Utility customers.

5.2.2 Provide Long-Term Reliability

Another important function of the Utility is to provide a reliable water supply system to its customers. Once a demand level is set, the amount of supply is dictated by the planning criteria that requires having enough water to meet the demands during a drought that typically occurs once every 50 years. The 1-in-50 drought criteria is considered a reasonable planning level that is used by other municipalities and has worked well for the City for the last few decades. In addition, a reliable system enables the City to supply water to its customers in an efficient manner while having the flexibility to handle different operating scenarios. Having several different sources of water and a few ways to deliver it to the treatment plant provides the City this reliability. Currently, the City's different water sources include Colorado-Big Thompson Project (CBT) water, native Poudre River flows and Joe Wright Reservoir releases. The City hopes to gain additional storage capacity in the near future, increasing the ability to manage the water rights portfolio and provide drought protection. Currently, the City can take water from the Poudre River in its older pipeline that diverts near Gateway Park and from the CBT Project at Horsetooth Reservoir. The City will soon be able to divert its additional Poudre River water rights through the new Pleasant Valley Pipeline during the

summer. In addition to reliability, having a diverse water supply system provides the City with the ability to better manage its water rights through increased opportunities to exchange water in the Poudre River Basin, ability to meet return flow obligations and overall efficient management.

5.2.3 Reduce Vulnerability

Having reliability and diversity in the water supply system also reduces the vulnerability in that system. The City could be vulnerable to such events as pipeline shutdowns, water source contamination (such as auto accidents in the Poudre River), as well as drought-related issues. Some of the water supply infrastructure used by the City, such as the City's original Poudre River pipeline and the CBT facilities, are aging and will be more susceptible to failure in the future. Also, recent national concerns with terrorist activities have increased the awareness of the vulnerability of all water supply systems. Again, having several different sources of water and a few ways to deliver it to the treatment plant reduces the City's vulnerability.

5.3 Water Supply Shortage Response Plan

Prior to the recent drought (2000-2003), the City did not have a written plan for responding to water supply shortages. In response to the severe drought year 2002 and in anticipation of continuing drought conditions, the City developed the Water Supply Shortage Response Plan, adopted by the City Council in April 2003 (Ordinance No. 48, 2003, included as Appendix C). The plan dictates the steps to be taken when there are water supply shortages and contains four different response levels based on the severity of the shortage. Although the Utility's main objective is to provide customers with an adequate and reliable water supply, there will be times when the City's water supply is projected to be less than anticipated demands. A response plan enables the City to quickly make the necessary adjustments in order to reduce water demands to a level that matches supply. It is anticipated that this plan will be reviewed periodically and may be changed in the future to match the City's changing water supplies, facilities and operations.

6.0 Projected Municipal Supply and Demand

6.1 Water Demand Projections

The primary factor in determining future water demands is population. The section below describes the process used to develop population projections that are then used to develop water demand projections.

6.1.1 Population Projections

The rate and pattern of population growth is often influenced by the future economy of the area, land use policies, development incentives and other factors. Estimating the future population to be served by the City of Fort Collins Water Utility is challenging since its service area boundary does not coincide with the city limits. This is further complicated by the fact that the boundaries vary for other Utility services (electric, wastewater, stormwater). To make this distinction, this report usually refers to the "Water Utility" when referring to the water service area served by Fort Collins Utilities. The Fort Collins-Loveland Water District (FCLWD) and the East Larimer County Water District (ELCO) provide water to some areas in the City and will most likely serve additional City residents in the future. The City Water Utility also serves some areas outside the city limits, primarily to the northwest of Fort Collins, including the water provided to the West Fort Collins Water District (WFCWD). All of these factors were considered in estimating the population for the Water Utility's service area. Figure 6-1 shows the different service areas with respect to the Fort Collins Urban Growth Area (UGA).

The projected population estimates for the Water Utility are based on the Traffic Analysis Zone (TAZ) information developed for the City of Fort Collins and Larimer County. The TAZ information is based on selected zones in and around the City that correlate with the City and County zoning designations, which dictate the type of development and their densities. The population within the Water Utility's service area is obtained by cross-referencing the service area with the TAZs. Future population projections are based on projected in-fill for each of the TAZs and assume that the rate of growth will be similar to past patterns. Projections have been made through the year 2040 to provide a long-term look at the effects of growth. Although the projections will not match the actual growth precisely, it is believed that these projections will provide a reasonable basis for the planning needed to project future water supplies and demands.

Population projections were made to separate out several key areas, as illustrated in Table 6-1 and Figure 6-2. First, a projection was made for the Water Utility's present service area (termed the "Utility Service Area"), which includes primarily an area within the City's boundary, but also includes a significant area northwest of Fort Collins, which is served with Utility water (including the WFCWD). Second, an estimate was made of the population that will potentially be served by two water districts, FCLWD and ELCO, within the Fort Collins UGA boundaries. The total of these two estimates provides an estimate of the total population projection for the UGA plus the area outside the City currently being served water by the Fort Collins Utility.

Figure 6-1
Fort Collins Treated Water Service Areas

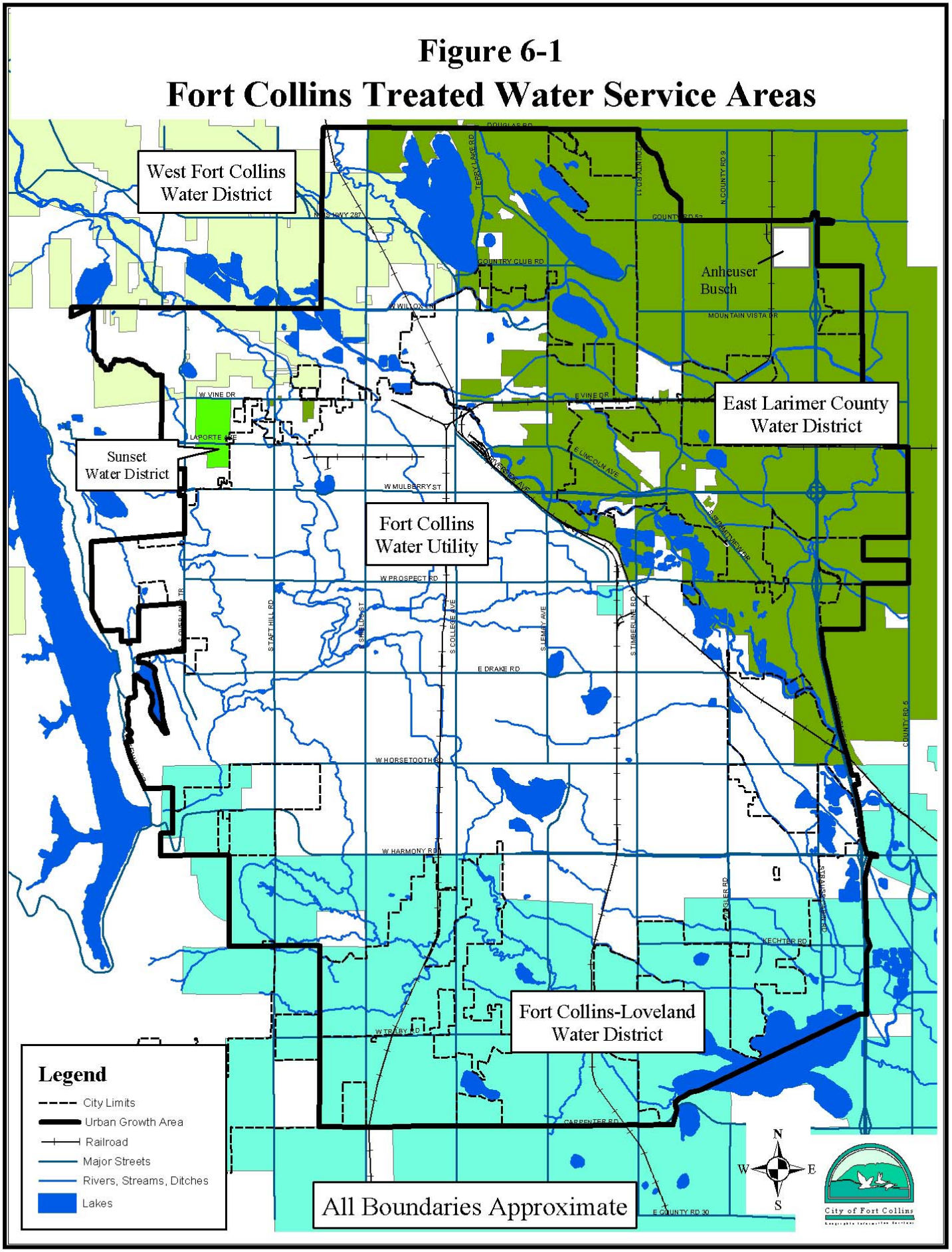
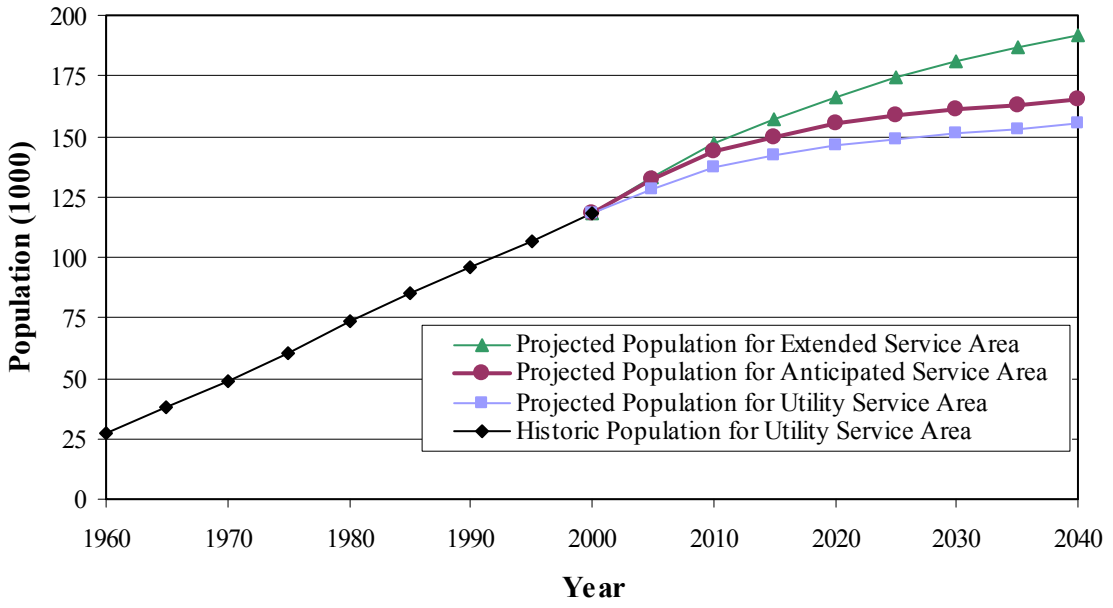


Table 6-1
Population Projections for Utility/City Service Areas

Year	Utility Service Area	Water District Service Area inside UGA	Total Utility/UGA	Utility S.A. + New Growth in Water District Service Areas within UGA (Extended Service Area)	Utility S.A. + Part of Extended S.A. to be City Served (Anticipated Service Area)
2000	118,000	18,000	136,000	118,000	118,000
2010	137,000	28,000	165,000	147,000	144,000
2020	146,000	38,000	184,000	166,000	155,000
2030	151,000	48,000	199,000	181,000	161,000
2040	155,000	55,000	210,000	192,000	165,000

Figure 6-2
Historic and Projected Population for Service Areas



Although the Water Utility's service area is limited by the surrounding water districts, the City currently has some water sale and exchange agreements to supply water to these water districts. With these agreements in place, and the potential for more in the future, it seemed prudent to consider supplying water for growth within the City that is outside the Water Utility's current service area. As of the year 2000, FCLWD and ELCO served approximately 18,000 people within the City boundaries. Since the City Water Utility will serve some of the new growth within the present water districts' service areas, and could have potentially served additional areas, another total was calculated by subtracting the existing 18,000 people from the total service area (Utility/UGA) being considered. This set of numbers provides an upper estimate of the population that the City Water Utility could have served during the study period (termed the "Extended Service Area"). It is expected that the actual population served will be somewhere between the estimates for the Utility Service Area and the Extended Service Area. Currently, the best estimate of the population that will be served by the Water

Utility in 2040 (termed the "Anticipated Service Area") is for an overall population of 165,000. This includes the projected growth within the City's current service area from 118,000 in 2000 to 155,000 by 2040 plus an additional 10,000 people by 2040 for the water provided through current agreements to the other water districts. City Council recently directed the Utility to limit planning to the Anticipated Service Area.

6.1.2 Treated Water Demand

Besides population, the other critical factor in projecting future treated water demands is assessing the amount of water used on the average by each person. For purposes of this report, this use is measured in gallons per capita per day (gpcd). The gpcd rate is then used to calculate a total demand in gallons per year and converted to acre-feet per year (325,851 gallons/acre-foot). Based on observations for the year 2001, before watering restrictions were implemented in drought years 2002 and 2003, the average use rate for that year was about 198 gpcd for the Utility Service Area. The gpcd rate used for the remainder of the study period is 185 gpcd, which is consistent with the demand rate set in the recently adopted Water Supply and Demand Management Policy (Resolution 2003-104).

In addition to population related growth, the City Water Utility also has an obligation to provide water for current and future large contractual use. Since large contractual use can significantly skew the per capita demand rates calculated for the City's water use, it is not used in the gpcd method of calculating future water needs. Instead, large contractual use is calculated on an individual basis and added to the overall current and future water demands. Currently, large contractual use is around 4,500 acre-feet per year. By the year 2040, large contractual use is anticipated to be around 8,500 acre-feet.

Table 6-2 shows a summary of the Water Utility service area historic use from 1960 and the projected demand through 2040 for the Utility Service Area, the Extended Service Area and the Anticipated Service Area. During the treatment process, a small percentage of the water is lost. This is added to the demands so as to reflect the amount of raw water supply that needs to be delivered to the treatment facility.

6.1.3 Raw Water Demand Projections

The City has various raw water demands that are met with available supplies. These demands include raw water for irrigation of parks, golf courses, a cemetery, school grounds and various other greenbelt areas. The current raw water demands range from about 3,000 to 4,000 acre-feet per year and are in addition to the supplies needed to meet treated water demands. There are also several raw water obligations totaling approximately 4,000 acre-feet per year that need to be met because of various exchanges and agreements. Although it is anticipated that the demand for raw water will increase in the future, these demands will probably be met with water rights provided to the City (in addition to the projected water rights acquisitions through the raw water requirements that will meet treated water demands).

Table 6-2
Historic and Projected Population and Treated Water Demand for Service Areas (1960-2040)

	Historic		Projected					
	Utility Service Area		Utility Service Area		Extended [1] Service Area		Anticipated [2] Service Area	
Year	Service Area Pop. (1,000)	Supply Needed For Treatment In Avg. Year [3,5] (Ac-ft)	Service Area Pop. (1,000)	Supply Needed For Treatment In Avg. Year [4,5] (Ac-ft)	Service Area Pop. (1,000)	Supply Needed For Treatment In Avg. Year [4,5] (Ac-ft)	Service Area Pop. (1,000)	Supply Needed For Treatment In Avg. Year [4,5] (Ac-ft)
1960	27.5	7,277						
1965	38.2	10,109						
1970	48.4	12,808						
1975	60.4	15,984						
1980	73.7	19,504						
1985	85.0	22,494						
1990	95.9	29,316						
1995	106.2	30,168						
2000	118.0	31,690						
2005			128.0	32,897	133.0	33,982	132.0	33,765
2010			137.0	35,088	147.0	37,202	144.0	36,568
2015			142.0	36,655	157.0	39,825	150.0	38,346
2020			146.0	38,010	166.0	42,238	155.0	39,913
2025			149.0	39,155	174.0	44,439	159.0	41,268
2030			151.0	40,087	181.0	46,428	161.0	42,201
2035			153.0	40,765	187.0	47,952	163.0	42,879
2040			155.0	41,443	192.0	49,263	165.0	43,556

Notes:
1. The Extended Service Area includes the City's current utility service area plus all new growth in the UGA that is not already served by the surrounding water districts.
2. The Anticipated Service Area includes the City's current utility service area plus some of the new growth in the UGA that is not already served by the surrounding water districts that the City is planning to serve.
3. Based on 225 gpcd for 1960-1990, 210 gpcd for 1995, and 198 gpcd for 2000; plus large contractual demands of 3,750 ac-feet for 1990-1995 and 4,010 ac-ft for 2000.
4. Based on 190 gpcd for 2005 and 185 gpcd for the remaining 2010-2040 planning period; plus large contractual demands increasing from 5,010 ac-ft in 2005 to 8,510 ac-ft in 2040 during the projected period.
5. An additional 5% for 1960-2000 and 2% for 2005-2040 of treated water use is included to process the water. The drop in amounts is due to backwash recycling implemented in 2003.

6.2 Water Supply Projections

The amount of water available for use is primarily a function of two things. The first is the potential yield of the water rights owned by the City. The second is the facilities that divert, convey and store these water rights.

6.2.1 Water Rights Portfolio

The City currently owns a plentiful portfolio of water rights, thanks to the foresight and action of past Water Boards, City Councils, Utilities staff and citizens of Fort Collins. The system of obtaining additional water rights through development requirements worked well in the past and should continue to help meet the water needs of the City. Developers have the option to meet the raw water requirements by turning in water rights acceptable to the City or by paying cash in-lieu-of water stock. The City uses the cash to purchase additional water rights when desirable or to develop projects that will increase the yield of the water rights owned by the City.

For purposes of projecting future water rights, a 50/50 split between water rights and cash payments for the new population-based demand has been assumed. The amount of water rights actually turned over to the City in any given year will vary depending on such factors as the local economy and rate of growth, the availability of water rights on the market and the cash in-lieu-of price set by the City. Based on the growth projections, an estimate of new water rights obtained during the study period was made for the Anticipated Service Area. Table 6-3 shows the projected yield of these water rights through 2040 for the Anticipated Service Area. Figure 6-3 illustrates graphically the projected water rights yields from the various sources.

It has been assumed that the projected increase in large contractual use (see section 6.1.2) will be met entirely with cash in-lieu-of water rights. When these projected cash payments are combined with the cash payments from other population-based development, the potential total payment through the planning period is estimated to be about $100 million for the Anticipated Service Area. These estimates are based on the current cash in-lieu-of rate of $6,500 per acre-foot of raw water requirement. The cash collected could be used to purchase additional water rights, acquire or develop additional storage capacity, or enter into other arrangements that will increase the long-term reliability of the City's supply system.

6.2.2 Water Supply System Constraints

The full use of the City's water rights in a given year can be reduced by several constraints. Generally, these can be divided into physical constraints and legal constraints.

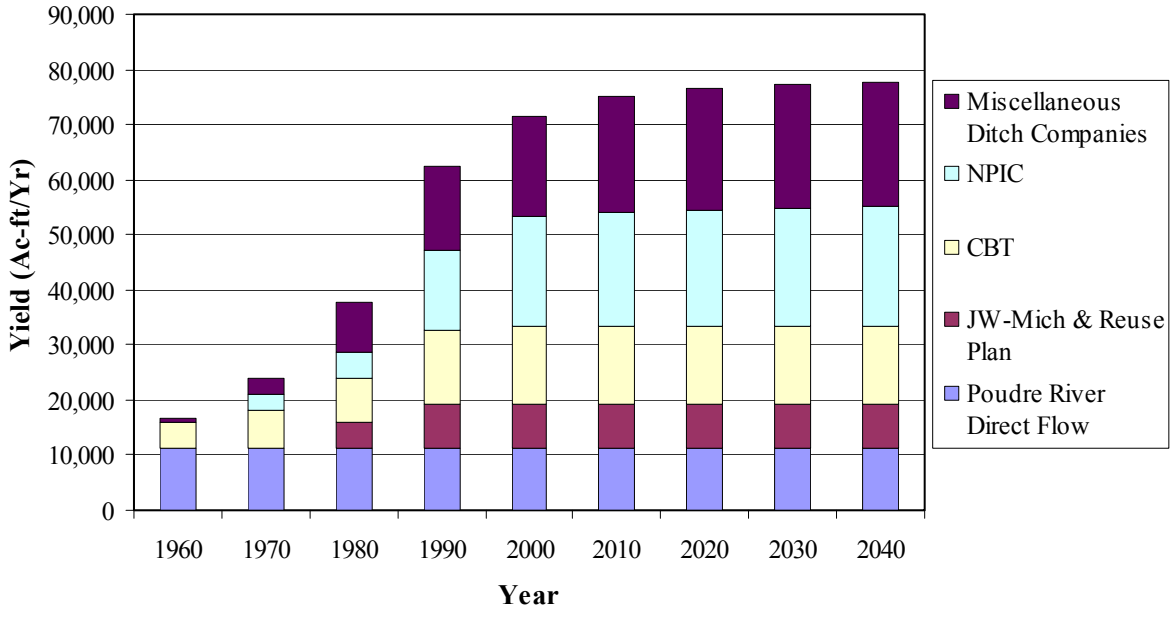
Physical constraints are primarily related to the pipeline capacity to convey water from the Poudre River to the water treatment facility and the lack of storage capacity to manage and regulate the water rights owned by the City. The capacity of the City's original Poudre River pipeline is about 20.9 MGD. This compares to the current peak day City use of about 60 MGD and direct flow water rights that sometimes exceed that amount. With the completion of the new Pleasant Valley Pipeline (PVP) in 2004, the City will increase the amount of water it diverts off the Poudre River during the summer months (April through October) by 60 MGD. The pipeline will deliver additional direct flows from the Poudre River consisting of the City's irrigation rights that have been converted from agricultural use to municipal use. The new PVP will be critical in meeting the future needs of the City by allowing use of converted irrigation water and providing reliability to the City's raw water delivery system.

Table 6-3
Historic and Projected Average Annual Yield for Anticipated Service Area

Source	Conversion Factor (Ac-ft/Sh)	Average Annual Yield (Ac-ft/Yr)								
		Historic					Projected			
		1960	1970	1980	1990	2000	2010	2020	2030	2040
Poudre River Direct Flow		11,300	11,300	11,300	11,300	11,300	11,300	11,300	11,300	11,300
Joe Wright-Michigan Ditch		0	0	4,800	5,500	5,500	5,500	5,500	5,500	5,500
Reuse Plan (PRPA)		0	0	0	2,300	2,300	2,300	2,300	2,300	2,300
NCWCD (CBT)	0.76	4,600	7,000	8,000	13,600	14,300	14,300	14,300	14,300	14,300
N. Poudre Irrigation Co.	5.57	0	2,800	4,700	14,600	19,800	20,800	21,200	21,500	21,600
Arthur Irrigation Co.	3.44	0	400	400	1,300	1,500	2,100	2,300	2,400	2,500
Larimer County Canal No. 2	42.69	200	300	1,600	2,700	3,500	4,200	4,400	4,500	4,600
New Mercer Ditch Co.	30.23	300	300	500	1,300	1,800	2,300	2,500	2,700	2,700
Pleasant Valley & Lake	39.74	200	1,800	4,500	6,300	7,000	7,500	7,600	7,700	7,800
Warren Lake Reservoir Co.	10.00	0	100	400	800	1,000	1,400	1,600	1,700	1,800
Water Supply & Storage Co.	84.00	0	0	1,400	1,900	2,200	2,200	2,200	2,200	2,200
Miscellaneous		0	0	200	700	1,200	1,200	1,200	1,200	1,200
Total		16,600	24,000	37,800	62,300	71,400	75,100	76,400	77,300	77,800

Notes:
1. Yields are the approximate average annual yields of the water rights and do not reflect weather variations and other physical and legal constraints in the system.

Figure 6-3
Historic and Projected Average Annual Yield for Anticipated Service Area



As the modeling results in the next section illustrate, the Water Utility needs additional water storage capacity to better utilize its water rights and increase the yield and reliability of its water supply system. Short-term storage is needed for operational flexibility and to meet return flow obligations inherent with converted irrigation shares. Long-term carryover storage is needed to capture water during wetter years for use during drier years. Both types of storage are needed to increase the reliability and redundancy desired to meet the growing water demands of the Utility's customers.

As described in section 4.5, legal constraints on the full use of the City's water rights are related primarily to Colorado water laws and the associated administration of water rights. Agricultural water rights that are acquired as shares in local mutual irrigation companies must be transferred to municipal use by applying to the Division 1 Water Court. Depending on the complexity of the transfer and who the objectors are, a transfer can be quite costly and take several years to accomplish. In order to protect other water users on the river and maintain the historic river conditions, strict accounting procedures are required. Since historic irrigation results in flows that return to the stream system throughout the year, releases from storage during the winter are often required. At any given time, many of the water rights owned by the City may not be available for municipal use depending on the status of a transfer case.

6.3 Supply and Demand Modeling

Because of the complexity of the City's water rights and supply system, a computer model was developed and used to evaluate future scenarios involving numerous water rights and increasing demands and supplies. This section describes the model used, some of the criteria and assumptions, and the results of the modeling.

6.3.1 Computer Simulation Model

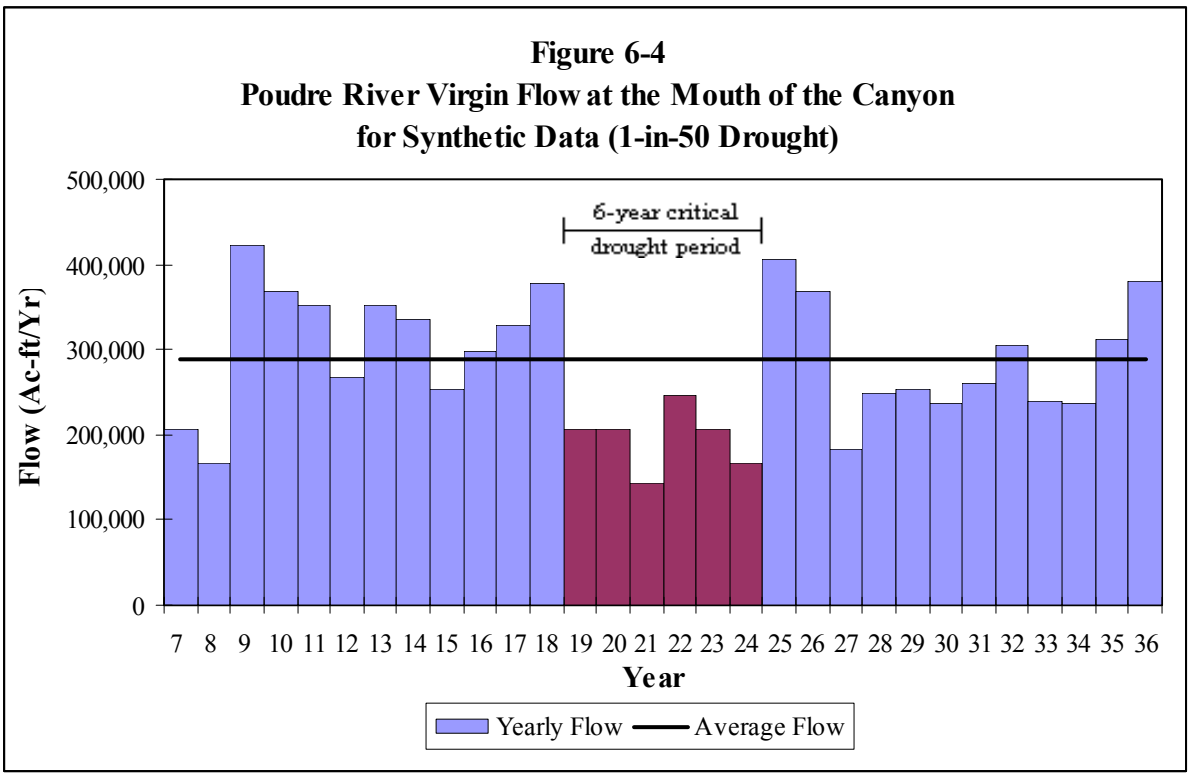
Modeling of the City's water supply system was done primarily with the "MODSIM" computer simulation model, developed by Dr. John Labadie and others at Colorado State University (CSU). MODSIM is a versatile, general-purpose river and reservoir operations model that uses cost minimization principles to simulate the prior appropriation water rights system used in Colorado and other western states. The Water Utility has used MODSIM since the mid-1980s to evaluate various water supply scenarios for the Poudre River Basin.

6.3.2 Simulated Drought

As set forth in the recently adopted Water Supply and Demand Management Policy (Resolution 2003-104), "*The reliability of the Fort Collins water supply should be maintained to meet at least the 1-in-50 drought event in the Cache la Poudre River Basin.*" Put simply, a drought is a period of below average runoff that can last one or more years and is often measured by its duration, average annual shortage and cumulative deficit below the average. A 1-in-50 drought corresponds to a dry period that is likely to occur, on average, once every 50 years. Although the Poudre River Basin has several drought periods in its recorded history, it is difficult to assess whether any of these droughts were equal in magnitude to a 1-in-50 drought. In 1985, the Water Utility worked with a consultant and CSU professor, Dr. José

Salas, to conduct a study using historic Poudre River virgin flow data to statistically define a 1-in-50 drought. A series of hydrologic traces were produced using the statistics from the historic record on the Poudre River and a 30-year period of annual runoff volumes was selected that included a 1-in-50 drought. This drought period is six years long and has a cumulative deficit of 550,000 acre-feet, which represents annual river volumes that are about 70% of the long-term average for the Poudre River. Figure 6-4 illustrates the 30-year synthetic Poudre River volumes that include the 6-year, 1-in-50 drought period.

Figure 6-4
Poudre River Virgin Flow at the Mouth of the Canyon for Synthetic Data (1-in-50 Drought)



The synthetic virgin flow data was then used as a statistical base to estimate yields of the various ditches and other supplies owned by the City. Most of the City's water rights are on the Poudre River and are affected by the available flows. However, one of the primary components of the City's raw water supply comes from the CBT system. The quota that NCWCD sets each year significantly affects the supply available in a given year. Because of this, the 1985 Drought Study reviewed the potential quota setting for the synthetic drought and developed a set of probable quotas for the 30-year period. The study determined a 50% quota for the critical year of the drought (i.e., the final and second driest year of the 6-year drought) would be likely.

6.3.3 Model Parameters

MODSIM is operated by loading numerous parameters into the model that allow it to simulate various future alternative supply systems. These parameters include demand amounts, reservoir volumes, inflow amounts, capacities, link costs and many others, all of which direct the program to allocate the water in the desired manner. In addition to the parameters needed

to run MODSIM, other modeling results were used to adjust the MODSIM input parameters to more accurately represent the use of the City's raw water resources. For example, raw water obligations were removed from the available supply to be treated, an operational reservoir of 2,000 acre-feet was added to meet return flow obligations from the use of the Southside Ditches (SSD) and winter releases from Halligan Reservoir were added to address environmental concerns downstream of the reservoir (for additional information regarding Halligan Reservoir, see "Long-Term Carryover Storage" at the end of section 6.3.5). Modeling criteria also provided for carryover storage equal to 15% of annual demands to be carried over in the most critical year of the modeled 1-in-50 drought. This provision recognizes the likelihood that in the critical year of a 1-in-50 drought, supplies would not be depleted at the end of the year, but rather some carryover would be desired for the following year in anticipation of the drought continuing. The 15% carryover would also provide an emergency supply in the event of a major problem or failure in one part of the raw water delivery system.

An important addition to the model, which may not be evident in the modeling results, involved the 2,000 acre-feet of SSD operational storage capacity. As discussed previously, return flow obligations accrue with the use of SSD water that must be met per the City's SSD Water Court decree. For ease of modeling, it was assumed the entire yield of the City's SSD water rights was utilized, maximizing the amount of return flow obligations. Although a portion of these obligations are met with return flows from the direct use of SSD water, part of them (mostly winter-time obligations) must be met with releases from storage. Due to minimum flow requirements dictated in the SSD decree at the Watson Lake diversion weir on the Poudre River, the 2,000 acre-feet of storage was modeled to directly release stored SSD water to the river to meet any winter-time obligations. Also, part of only the May and June SSD flows were stored in the 2,000 acre-feet reservoir, since these are the months that flows are usually in excess of demands.

6.3.4 Modeling Alternatives

After many months of gathering data and making numerous trial model runs, four different scenarios for five different points in time were modeled for the Anticipated Service Area to be presented in this report. It became clear that there are a few key variables that have significant impacts on the Utility's ability to meet projected water demands. These variables include (1) the projected water demands and the associated water rights that would become available with anticipated growth, (2) the increased capacity of the new Pleasant Valley Pipeline (PVP), (3) the availability of operational storage capacity and (4) the availability of long-term carryover storage.

Four different scenarios considering the above variables were modeled with MODSIM for five different periods. The major difference between the scenarios is the facilities that are assumed to be available to deliver water to the Water Utility's treatment facility. The four scenarios, each with different facilities, are (1) existing facilities, which includes the new PVP and 2,000 acre-feet of SSD operational storage (termed EF&OS for "existing facilities and operational storage"), (2) EF&OS and 9,000 acre-feet of storage in Halligan Reservoir, (3) EF&OS and 12,000 acre-feet in Halligan, and (4) EF&OS and 20,000 acre-feet in Halligan.

Although a representation of Halligan Reservoir was used in the modeling, it should be noted that other similar storage facilities might be able to fulfill the need for carryover storage. These scenarios were modeled for the Anticipated Service Area that the Utility will likely be servicing and for the years 2000, 2010, 2020, 2030 and 2040.

6.3.5 Modeling Results

Each scenario was modeled for all years to obtain the firm yield (see section 4.3) or safe average annual demand (SAAD). The SAAD is the maximum average demand that can be satisfied with the supplies and facilities for the given year's scenario. It reflects the maximum demand level that can be met with the given supply. In other words, a particular year's supply scheme was loaded into the model and the population was adjusted so that the highest demand level could be met without incurring shortages in any of the 30 years in the simulation period. It should be noted that the critical year of the simulated 1-in-50 drought period is the one that usually dictates the upper limits of the SAAD, since that year is when all sources are used to their fullest extent. Table 6-4 summarizes the SAAD results for each year and each scenario for the Anticipated Service Area. In order to give a better visual representation of these values, the results are also graphically represented in Figure 6-5.

With the addition of the new PVP and some operational storage in the near future, the City's ability to meet demands during a 1-in-50 type drought has greatly improved. This should assure that the Utility's water supplies will be able to meet the 1-in-50 drought criteria for the next several years. However, the results indicate that certain facilities will be needed in the future to meet the projected demands within the context of the 1-in-50 drought. For example, Figure 6-5 shows the Treated Water Demands for Anticipated Service Area line crossing the SAAD with Existing Facilities & Operational Storage (EF&OS) line just beyond the year 2010. This indicates that long-term carryover storage capacity will be needed at that time to meet at least the 1-in-50 drought criteria. By the year 2040, the graph indicates that approximately 12,000 acre-feet of carryover storage capacity would be needed to meet the drought criteria for the Anticipated Service Area. The reason three sizes of carryover storage are modeled is to show the effect that different storage amounts have on the SAADs.

It should be noted, as a general caveat, that the results of the MODSIM model are based on its input, which includes many variables and assumptions. Although the results are not precise, they should provide reasonable guidance as to the type and size of facilities needed to meet a range of future water demands.

Effect of Additional Water Rights

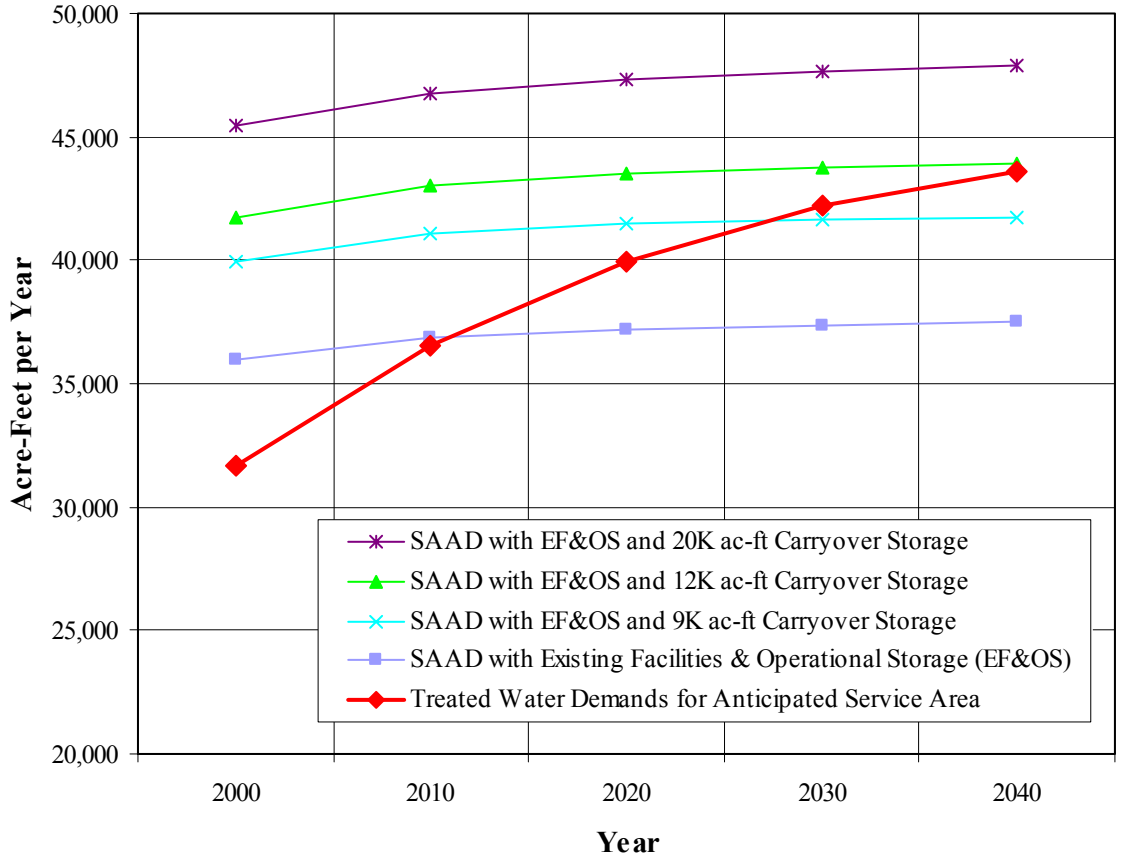
The effect of increasing the ownership of water rights is relatively small compared to the effect of increasing pipeline and storage capacity. This effect can be observed by looking at Figure 6-5. The slight increase in the various scenarios as one goes from 2000 to 2040 is due to the acquisition of additional water rights. The SAAD increases significantly when facilities are put in place, partly because it allows for the diversion or storage of water rights that are already in the City's existing water rights portfolio.

Table 6-4
Safe Average Annual Demand (1-in-50 Drought) for Anticipated Service Area

Year	Service Area Population	Treated Water Demand (Ac-ft/Yr)	Scenarios: SAAD for Existing Facilities & Oper. Storage (EF&OS) (Ac-ft/Yr)	SAAD for EF&OS and 9K Ac-ft Carryover Storage (Ac-ft/Yr)	SAAD for EF&OS and 12K Ac-ft Carryover Storage (Ac-ft/Yr)	SAAD for EF&OS and 20K Ac-ft Carryover Storage (Ac-ft/Yr)
2000	118,000	31,690	35,977	39,962	41,734	45,445
2010	144,000	36,568	36,836	41,094	43,036	46,769
2020	155,000	39,913	37,181	41,462	43,508	47,304
2030	161,000	42,201	37,378	41,639	43,727	47,627
2040	165,000	43,556	37,524	41,763	43,893	47,858

Notes:
1. The "Safe Average Annual Demand" (SAAD) is the maximum average annual demand that can be satisified with the supplies and facilities for the given year. A 30-year hydrologic computer simulation containing a 1-in-50 year type drought was used to determine the SAAD.
2. Existing facilities and operational storage includes the new Pleasant Valley Pipeline (PVP) and 2,000 ac-ft of operational storage.

Figure 6-5
Projected Treated Water Demands for Anticipated Service Area vs. Safe Average Annual Demands (SAAD) for Various Supply and Facility Scenarios (1-in-50)



One way to compare the effect and cost of more water rights as compared to storage capacity is to look at the per unit cost of developing new firm yield. This is illustrated in Table 6-5 and Figure 6-6. The cost of acquiring additional firm yield by acquiring CBT or NPIC water is about $22,000 and $21,000 per acre-foot, respectively. The cost of acquiring additional firm yield from SSD shares is around $13,000 per acre-foot, which does not include the cost of operational storage needed to use these shares. This is compared to a range of costs estimated for the permitting and construction of Halligan Reservoir, which range from about $2,200 per acre-foot of firm yield (with partners) to $4,100 per acre-foot of firm yield (without partners). The firm yield from obtaining storage in Halligan Reservoir (or a similar project) is associated with an increase in the total yield of the City's water supply system (or the ability to increase the SAAD). The increased firm yield from storage to other water providers and their supply systems may be different, affecting the price per acre-foot of firm yield.

Operational Storage

Through the development and operation of the MODSIM model and associated spreadsheet models, it became clear that the City has a need for up to 2,000 acre-feet of operational storage capacity. This will become increasingly true as water demands increase and as the City begins to use more of its converted irrigation company shares for municipal use.

As previously discussed, in the process of converting irrigation rights obtained by the City to municipal use, it is necessary to meet certain return flow obligations. The historic use of irrigation water includes directly applying the water to agricultural fields, part of which is consumed by the crops through evapotranspiration, part of which returns to the river quickly via direct surface flows and part of which returns to the river slowly via groundwater conveyance. When irrigation rights are converted to municipal use, only the water consumptively used by the crops is allowed to be fully used to extinction by a municipality. The amount of irrigation water that historically flows back to the river must continue to flow back to river at the same rate and within the same period to prevent injury to other water users on the river. Since a portion of the flow returns to the river in the winter months via groundwater, there must be a method of meeting these winter return flow obligations. The use of a storage reservoir would meet these obligations by allowing the winter return flows to be released back to the river at the appropriate time.

Converted irrigation water that was historically consumed by crops can be used to extinction and is therefore termed "reusable" water. This type of water is very valuable for a number of reasons. Reusable water can be used to replenish losses associated with evaporation from storage facilities, for groundwater well augmentation and for other similar uses. It can also be treated and the effluent exchanged upstream with other water in the river to a City pipeline to be treated again, until it is fully consumed to extinction. The water from the SSD will probably be needed to meet these kinds of reusable demands. However, some operational storage capacity is needed to meet all the requirements of the applicable Water Court decrees. The most efficient location for this kind of storage is near Fort Collins, close to the original diversion points of the SSD and the areas where return flows historically occurred. Local gravel pits or other nearby reservoirs would meet annual operational storage needs.

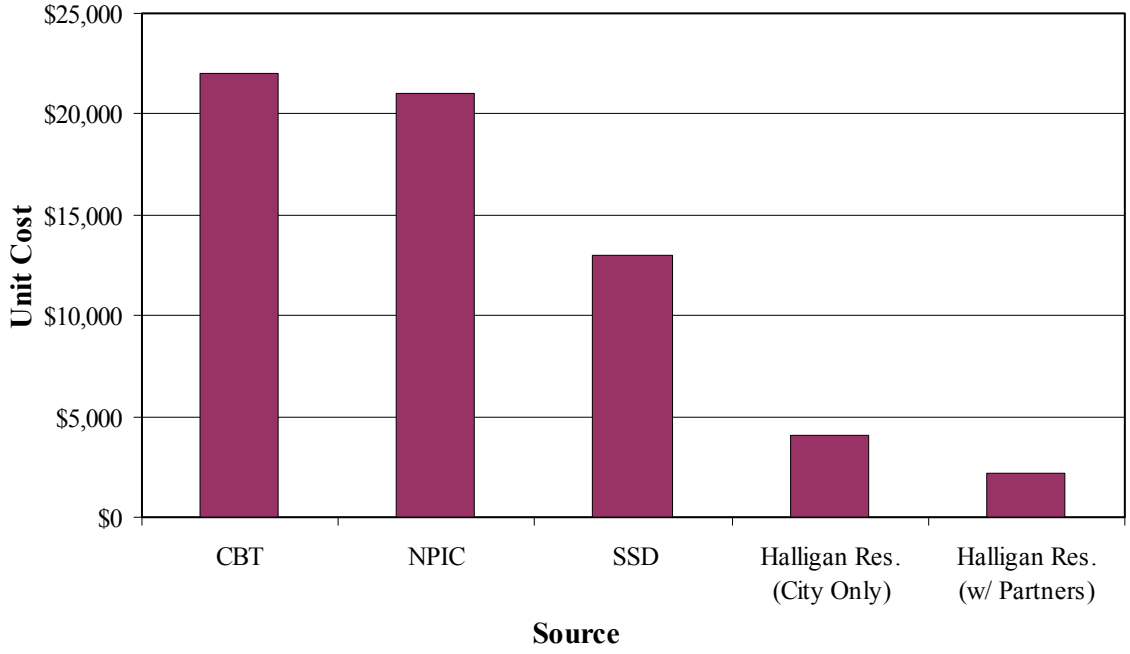
Table 6-5
Comparison of Firm Yield Costs

City Accepted Sources			
Source	Price per Unit	Firm Yield (Ac-ft/Unit)	Price per Ac-ft of Firm Yield
Colorado-Big Thompson	$11,000	0.50	$22,000
North Poudre Irrigation Company	$42,000	2.00	$21,000
Southside Ditches[1]	$6,500	0.50	$13,000

Halligan Reservoir Enlargement					
Enlargement[2] Capacity (Ac-ft)	City's Share of Enlargement (Ac-ft)	Increased System[3] Firm Yield (Ac-ft)	Cost of[4] Reservoir	City's Share of Reservoir Cost	Price per Ac-ft of Firm Yield
12,000	12,000	6,400	$26,000,000	$26,000,000	$4,100
33,500	12,000	6,400	$40,000,000	$14,000,000	$2,200

Notes:
1. The price for the Southside Ditches (SSD) firm yield does not include the cost of operational storage needed to meet return flow obligations.
2. The two scenarios listed for enlargement capacity are 12,000 ac-ft, which represents a City only enlargement, and 33,500 ac-ft, which represents a fully enlarged reservoir that would be shared with partners.
3. Increased system firm yield is based on the Safe Average Annual Demands for 2040 model simulation.
4. The costs listed here are only for permitting, design and construction of the reservoir.

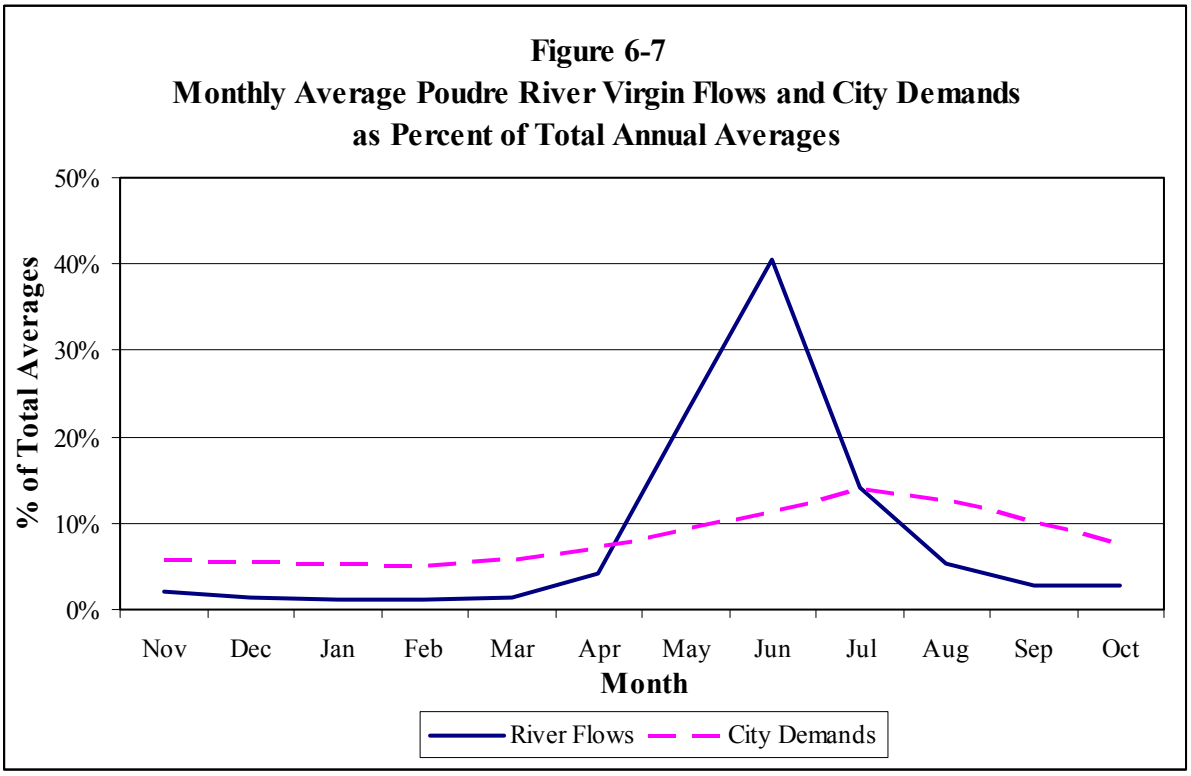
Figure 6-6
Price per Acre-Foot of Firm Yield



Long-term Carryover Storage

Modeling the water supply system for the Anticipated Service Area identifies the need for long-term carryover storage by approximately 2010 with a total capacity needed in 2040 of around 12,000 acre-feet. Although the City's water supply portfolio contains enough sources to meet demands in most years, the yields of many of these sources are greatly diminished in extremely dry years. In addition, the yield from many of the City's water rights comes during the peak runoff period, usually in May and June. Figure 6-7 compares the pattern of the runoff from the Poudre River with the demand pattern for the City municipal use. Because of the difference in timing between supply availability from the river and demands by City customers, some storage capacity is needed to shift water from high-flow months to low-flow months and from wet years to dry years. By doing this, the City's supplies can be more fully utilized and a significantly higher level of demand (or SAAD) can be met. This is illustrated by the results of the model runs showing the significant increase in SAAD with the addition of carryover storage capacity.

Figure 6-7
Monthly Average Poudre River Virgin Flows and City Demands as Percent of Total Annual Averages



Halligan Reservoir, located on the North Fork of the Poudre River approximately 25 miles northwest of Fort Collins, has been identified by the City and others (see Cache la Poudre Basin Study, 1987) as a viable location for additional storage in the Poudre River Basin. The City has been pursuing the enlargement of Halligan Reservoir since the mid-1980s and has conducted feasibility studies for its enlargement in 1989 and again in 2002. These studies have indicated the site could be expanded up to 40,000 acre-feet at a relatively low cost. Subtracting the existing 6,500 acre-foot storage right, a fully expanded Halligan would provide up to 33,500 acre-feet of additional storage. In 1993, the City entered into an

agreement with Halligan's owner at the time, the North Poudre Irrigation Company (NPIC), to reserve the option of acquiring and enlarging the existing reservoir. On November 4, 2003, City Council approved Resolution 2003-121, which allowed the City to exercise the NPIC option agreement and to proceed with development of Halligan Reservoir. Although the City has been actively pursuing Halligan Reservoir as an attractive means of acquiring carryover storage, it should be noted that other similar storage facilities might be able to fulfill the need for drought protection.

6.3.6 Supply Alternatives

Although the City has been actively pursuing Halligan Reservoir as a means of meeting future needs, there are several alternatives that have been explored by the City. Alternatives to Halligan Reservoir as long-term carryover storage can be found in other storage projects. One alternative storage project that is currently in the works is the Northern Colorado Water Conservancy District's (NCWCD) Northern Integrated Supply Project (NISP), which would provide new water yield and long-term carryover storage for numerous entities along the northern Front Range. NISP would store unappropriated waters from the Poudre River in a reservoir near the mouth of the Poudre River canyon. Other storage alternatives include using local gravel pits or existing local irrigation reservoirs for storage.

Another supply alternative is to forego long-term storage and only acquire water rights to meet future demands. These water rights would probably come from the agricultural community. The City would need to purchase numerous shares of these agricultural rights in order to yield enough water during the dry years to meet the City's 1-in-50 drought criteria. This would be costly and would result in the City purchasing water from large tracks of productive agricultural lands.

Reducing demand for water is another supply alternative. If demands are reduced, the water that is saved can go towards meeting future water demands, instead of having to obtain additional supplies. The newly adopted Water Supply and Demand Management Policy has set a goal of reducing water demands from a previous target of 195 gpcd to 185 gpcd by the year 2010. This level of reduction will lessen the amount of water needed by the City for future demands. However, reducing demands even further could make the City vulnerable to droughts that exceed (or are more severe than) the 1-in-50 drought criteria and could also affect the economic viability of the City.

6.4 Conclusions

Several general conclusions can be made regarding projected water demands and measures that are needed to maintain a reliable municipal water supply system:

1. Water demands are expected to increase about 37% between the years 2000 and 2040.
2. New water rights will help meet increased water demands but their effect will be relatively small compared to the benefits of additional storage capacity.

3. Up to 2,000 acre-feet of "operational storage" is needed to adequately manage and meet return flow obligations related to the conversion of irrigation company shares from agricultural use to municipal use.
4. Approximately 12,000 acre-feet of "long-term carryover storage" is needed to significantly increase the City's ability to meet water demands during at least a 1-in-50 drought.

7.0 Development of Policy Elements

Utilities staff worked with the Water Board's Water Supply and Water Conservation and Public Education Committees over the last several years to review and update the City's Water Supply Policy (Resolution 88-205) and Water Demand Management Policy (Resolution 92-63) that were adopted in December 1988 and April 1992, respectively. The result of this work was the development of the Water Supply and Demand Management Policy, which was adopted by the City Council on September 16, 2003 (Resolution 2003-104). This section of the report lists each of the proposed policy elements and discusses the reasons, conclusions and strategies for each of them. The full adopted policy is provided as Appendix D of this report. The policy issues discussed are as follows:

1. Demand Management
    a. Water Use Goals
    b. Educational Programs
    c. Rate Structures
    d. Incentive Programs
    e. Regulatory Measures
    f. Operational Measures
2. Water Supply for Municipal Use
    a. Drought Criteria
    b. Raw Water Requirements (RWR)
    c. Storage Capacity
    d. Use of Existing Supplies
3. Water Supply Shortage Response Plan
4. Use of Surplus Raw Water
5. Regional Cooperation
    a. Working with Other Municipal Providers
    b. Working with Local Irrigation Companies
    c. Transferring Water Rights from Agricultural to Municipal Use
6. Raw Water Quality
7. Stream Flow and Ecosystem Protection
8. Recreational/Aesthetic Flows

7.1 Demand Management

Demand management is an essential part of the updated and combined policy. Reducing the City's water use helps to reduce water supply system costs while promoting a conservation ethic. Effective demand management starts with setting water use goals. Several tools are available to accomplish the intended water use goals and include (1) educational programs, (2) rate structures, (3) incentive programs, (4) regulatory measures and (5) operational measures. Each of these items is discussed in the following sections.

7.1.1 Water Use Goals

Policy Element

The City will implement the necessary water conservation practices and programs to reduce its water use to an average of 185 gallons per capita per day (gpcd) by the year 2010. In addition, the per capita peak daily demand will be reduced to 475 gpcd by the year 2010. These calculations are based on the total treated water produced for use by City customers (adjusted for large contractual customers and other sales or exchange arrangements) divided by the estimated population of the City's water service area.

Discussion and Conclusions

Since the original Water Demand Management Policy (Resolution 92-63) was adopted in 1992, the City instituted a water-metering program, set up an extensive leak detection system, created pricing incentives that reduce water use and increased educational outreach to better inform the public. As a result, the per capita use of water dropped approximately 16% from 235 gpcd to 198 gpcd by 2001, approaching the 2010 target of 195 gpcd.

Recent studies conducted by staff indicate that water demands can be reduced even further (see section 4.1.3). It appears reasonable for the City to obtain an adjusted per capita annual consumption of 185 gpcd by the year 2010, which is a 5% reduction from the previous target. Based on the decreased goal in the per capita annual consumption, the adjusted per capita peak daily demand should also decrease from the previous target of 502 gpcd to 475 gpcd by the year 2010. These new demand levels are obtainable without affecting the beneficial uses of water enjoyed by existing and future customers, simply by reducing unnecessary water use.

Commercial water use has not significantly decreased since Resolution 92-63. This may be a result of the nature of commercial use (different businesses use different amounts) and the increase in commercial customers since 1992.

Strategies

(1) Use other demand management policies to meet water use goals to make efficient use of water and continue City's conservation ethic.
(2) Study commercial use patterns to determine whether potential reductions are needed.

7.1.2 Educational Programs

Policy Element

The City will have a continuous, comprehensive and visible public education program that helps citizens and businesses use water appropriately and efficiently. Examples of such programs include (1) working with the schools to provide water conservation education, (2) promoting the use of Xeriscape landscaping for public facilities, businesses, homeowners, and others, (3) helping the public to understand and utilize evapotranspiration information in

determining their irrigation applications, and (4) educating water users on the operation of sprinkler system controllers.

Discussion and Conclusions

Educational programs have long been the cornerstone of the City's water conservation efforts. Education helps raise public awareness about the City's water supply situation, the need for conservation and ways to conserve. To encourage long-term water conservation and instill water-efficient behaviors among all age groups and sectors, the City's educational programs focus on reaching youth and adults, residences and businesses.

Public information efforts include bill stuffers, news releases, public service announcements (PSAs) on radio and television, web site information, programs and workshops. Conservation brochures are distributed on indoor conservation tips, Xeriscape and water-wise watering practices. Presentations are given to community clubs and organizations. During the recent drought (2000-2003), the City's campaign also included print advertising, bus benches and tent cards for hotels/motels and restaurants.

Because water use is higher during the summer, primarily due to landscape watering, education has targeted reduction of the amount of water people use outdoors. To encourage Xeriscape, the City distributes a wide variety of free brochures, maintains a Xeriscape demonstration garden in front of City Hall and provides seminars about Xeriscape. The City also sponsors programs for homeowners and landscapers on water-efficient irrigation techniques and technology.

Although past conservation efforts have focused on residential water use, outreach has recently been expanded to target commercial customers. Outreach to commercial customers includes newsletters, mailings, meetings and seminars. The Utilities has held meetings on various topics for specific segments of customers, such as restaurants, hotels, car washes, landscapers and large accounts.

Future activities may include partnering with nurseries to distribute information, providing more resources for commercial customers, working with home builders to encourage Xeriscape and developing an award program for water-saving activities.

Since 1977, staff has worked with the Poudre School District to teach youth the value of water resources and instill in them a conservation ethic. School programs are popular, as are materials such as the *Fort Collins Water Story*, developed in-house. Approximately 2,000 students annually attend the one-day Children's Water Festival, initiated in 1991. The WaterSHED program offers educational programs and teacher training about water quality issues in the City's local watersheds. Dr. WaterWise, a water conservation curriculum, was introduced to the schools in 2002. Work is underway to develop youth education pages for the City's web site.

Strategies

(1) Continue public information outreach through a variety of mediums; revise as appropriate.
(2) Expand outreach effort to commercial customers. Provide programs targeted to various customer types.
(3) Continue WaterSHED, Dr. WaterWise, teacher training and other youth education activities; expand and revise as appropriate.

7.1.3 Rate Structures

Policy Element

The City will have water rate structures for all classes of customers that provide an economic incentive to use water efficiently. Examples of structures that may be utilized include (1) tiered structures with increasing prices as water use increases, (2) seasonal blocks with higher rates during the irrigation season, (3) water budget approaches based on appropriate targets for individual customers, and (4) flat rate structures.

Discussion and Conclusions

Rate structures are an effective tool to help meet water use goals. Providing an economic incentive to use water efficiently has been proven in other parts of the nation as an effective way to reduce water use. However, it is difficult to set rate structures that are fair and equitable to all customers and do not penalize the beneficial use of water. There are several rate structures that can be used which are briefly discussed below.

All Utility customers are now metered (as of 2003) and billed for the amount of water they use. Commercial, industrial and multi-family customers have been metered for numerous years. Prior to the completion of the metering program, unmetered residential customers were billed a monthly flat charge which varied by customer based on lot size. Since the Utility has operational expenses that are independent of the amount of water used, rates for metered customers have included a fixed charge to stabilize the revenues which covers some of these expenses. In addition to the fixed charge, there is a variable rate that is applied to the amount of water that the metered customer uses.

Prior to 2003, the City used a flat rate structure to charge its metered customers. A flat rate structure charges the same amount per thousand gallons regardless of the amount used. Although not as strong as other rate structures, flat rates provide an economic incentive to use water efficiently since the more one uses, the more one pays.

In response to severe drought conditions in 2002, the City implemented a tiered rate structure for single-family and duplex residential customers. The rates were designed to achieve water savings during the drought and went into effect in January 2003. Tiered rate structures are designed to charge an incrementally higher rate for higher water use. For example, in 2003 the tiered rate structure was designed with a fixed charge of $12.00, a variable rate of $1.68 per

thousand gallons ($1.68/kgal) for water use between 0 and 7,000 gallons, $2.24/kgal for use between 7,001 and 13,000 gallons, $2.80/kgal for use between 13,001 and 20,000 gallons, etc. While the tiered rate approach provides more of an incentive to use water efficiently than a flat rate structure, it has some drawbacks. Customers with larger lots who apply the same amount of water (in inches) on their landscapes as those with smaller lots, will probably be paying at the higher steps of the rate structure. This may be seen as inequitable since larger lot owners have transferred more water to the City to meet the raw water requirements and may be irrigating more efficiently than smaller lot owners.

The water budget approach uses a tiered rate but incorporates lot sizes to compute individual budgets for landscape watering needs. If a customer's use is in excess of the budget for their lot size, they enter a higher tier on the rate structure. A water budget provides an economic incentive to conserve water, while recognizing that appropriate use levels are a factor of such things as number of people in the home and lot size.

Seasonal block rate structures raise the rates in the summer to promote water savings during the irrigation season. Seasonal block rate structures were implemented for commercial and multi-family customers starting in 2003. Since it is often difficult to determine irrigated acreage for commercial and multi-family landscapes, the water budget approach would not work easily for these customer classes. Also, a tiered rate structure would be hard to implement for commercial customers as different businesses use water differently.

Future rate structures should be designed to encourage conservation without reducing the benefits as defined by the community. Rate structure design should be done carefully and attempt to be as equitable to all customers as possible.

Strategies

(1) Structure rates to help the Utility achieve its water use goals while being fair and equitable to all its customers; revise as appropriate.

7.1.4 Incentive Programs

Policy Element

When determined to be cost effective, the City will implement incentive programs that will assist customers in replacing outdated plumbing fixtures or landscape features that use excessive amounts of water. Examples for reducing indoor use are rebates for replacing showerheads, toilets and clothes washers with water conserving models. Examples for reducing outdoor use include rebates for expenses related to irrigation scheduling equipment and converting landscape to Xeriscape.

Discussion and Conclusions

Incentive programs typically provide rebates, loans, services or goods to customers to encourage them to use a more efficient technology. Rebates could be offered for the

installation of water-saving plumbing fixtures, appliances, irrigation technology and landscape to help obtain additional water savings for the City as a whole.

Since 1991, Utilities has administered a zero interest loan program (ZILCH) for water service line replacements, ultra-low flush toilets and plumbing repairs. Over time, the types of improvements included in the loan program have been adjusted to meet evolving technology.

For the past five years, Utilities has offered sprinkler audits for homeowners and homeowner's associations to teach them about efficient sprinkler system operation and maintenance. During 2003, 6,000 water conservation kits were distributed to residential customers. Two kits were offered: a retrofit kit for indoor fixtures (showerhead, faucet aerators and dye tables to detect leaks in toilets) and an outdoor kit to help with landscape watering (hose nozzle, soil moisture meter and a rain gauge).

Also in 2003, the City became an ENERGY STAR partner and participated in an ENERGY STAR rebate program for high-efficiency clothes washers. During the three month program, 427 $100 rebates were processed, funded half by the Utilities and half by washer manufacturers. After the end of that program, the Utilities continued a $50 rebate program for residential customers.

In the future, other rebates or ZILCH loans will be considered. Some possibilities include ENERGY STAR dishwashers, weather-based irrigation controllers and Xeriscape retrofits. Incentives being considered for commercial customers include financial incentives for water saving upgrades, such as water-cooled to air-cooled equipment and one-pass to recirculating cooling systems. Other incentives could include water audits for multi-family and commercial buildings.

Strategies

(1) Continue clothes washer rebates, ZILCH loans and sprinkler audit program.
(2) Consider additional rebates, loans and other incentives to encourage the use of more efficient technology.
(3) Evaluate incentive program offerings on an annual basis; revise as appropriate.

7.1.5 Regulatory Measures

Policy Element

The City will maintain and/or adopt regulations that promote water efficiency and reduction of water waste while recognizing the benefits of adequate water to maintain an attractive and pleasant environment in the City. Examples include regulations that require the amendment of soils with organic materials and prohibition of homeowner associations banning the use of Xeriscape. The City will also review its Land Use Code for potential revisions which would limit bluegrass turf on new landscapes and prohibit landscaping that requires irrigation in certain areas such as medians, thin strips, and other small areas.

Discussion and Conclusions

Regulations are designed to limit a specific type of water use. They may be effective for saving water, but are not the most popular water conservation measures with customers.

The City has a wasting water ordinance (Municipal Code Sec. 26-166) that says, "It is unlawful to waste city water in any manner." The Land Use Code (Section 3.2.1 E3 and J2) requires new developments to comply with the *Water Conservation Standards for Landscaping and Irrigation*. To reduce demand during the recent drought (2000-2003), mandatory water restrictions were put in place in 2002 and 2003. In 2003, the restrictions broadened to apply to water uses other than lawn watering. Also in 2003, City Council adopted regulations (Ordinance No. 084, 2003) that require builders to amend the soil for new properties and prohibit homeowner association covenants from banning the use of Xeriscape.

Potential future regulations include a landscape ordinance to limit turf areas to a percentage of a lot's irrigable area, prohibit turf in narrow strips, require a dedicated irrigation tap for large commercial properties or require rain shut-off devices for sprinkler systems. Other possible regulations could require new drive-through car washes to recycle water, require ultra-low flush toilets be installed at the time of a property sale, prohibit single-pass cooling systems in new buildings or set regulations for cooling towers.

Strategies

(1) Review and evaluate current water conservation regulations on an annual basis: revise as appropriate.
(2) Consider additional regulations to achieve target water goals.
(3) Enact water restrictions as listed in the *Water Supply Shortage Response Plan (Ordinance No. 048, 2003)* when water shortage levels are reached.

7.1.6 Operational Measures

Policy Element

The City will establish practices and procedures to deliver and use water in its facilities without excessive losses. Examples of such practices are the leak detection program to reduce losses through the Utility's water distribution system and the recycling of backwash water at the Water Treatment Facility.

Discussion and Conclusions

The Utility has been progressive in employing measures that help save both raw and treated water. Examples of these measures include the water distribution leak detection program and the recently implemented backwash water recycling equipment at the treatment plant. The Utilities has administered a leak detection program since 1993. Sound detection equipment identifies small to moderate leaks so they can be repaired before they become large leaks. This program has considerably reduced unaccounted for water use.

The backwash water recycling equipment started operating in April 2003. Previously, filters were cleaned periodically by reversing flow through the filters and the "backwash" was discharged into a local irrigation ditch. The new equipment uses ultraviolet technology to treat the backwash water and recycles the water to the beginning of the treatment process. The technology will save the Utility approximately 5% of total water treated annually.

As technologies in water treatment and distribution improve, opportunities to implement systems to save water may arise. When it is deemed reasonable and cost-effective, these technologies should by used.

Strategies

(1) Explore and implement water saving measures within the Utility operations when deemed reasonable and cost-effective.

7.2 Water Supply for Municipal Use

One of the primary objectives of the Water Utility is to provide an adequate and reliable supply of municipal water to City residents and other water users. The City needs to adopt policies that will help it meet future water demands in its service area in an efficient and reliable manner. Key elements that need to be considered when discussing water supply for municipal include (1) drought criteria, (2) raw water requirements, (3) storage capacity and (4) use of existing supplies. Each of these items is discussed in the following sections.

7.2.1 Drought Criteria

Policy Element

The reliability of the Fort Collins water supply should be maintained to meet at least the 1-in-50 drought event in the Cache la Poudre River Basin. Water rights and storage capacity should be acquired ahead of the time it is needed to meet at least the 1-in-50 drought criteria, so as to provide enough time to seek and obtain water court decrees and diversion or storage facilities, if needed, to use such water.

Discussion and Conclusions

Drought criteria were carefully considered at the time the City Council established the 1988 Water Supply Policy (Resolution 88-205). The 1985 Drought Study considered droughts with return frequencies of 1-in-20, 1-in-50, 1-in-100 and 1-in-500. The original recommendation was to adopt a 1-in-100 standard for meeting a drought. After much deliberation, the council decided that meeting at least the 1-in-50 drought with no restrictions would provide adequate protection from drought. It was believed that droughts of higher severity could be met with restrictions and/or other conservation measures. Several other cities along the front range also use the 1-in-50 drought or similar criteria when planning their raw water supply systems.

Water rights turned over during the last decade presently provide the necessary supplies to meet at least the 1-in-50 drought criteria. Projected acquisitions and improvements to the system are anticipated to provide at least 1-in-50 protection during the planning period ending in 2040.

Strategies

(1) Continue to use the 1-in-50 drought criteria to plan for the City's future water needs.

7.2.2 Raw Water Requirements (RWR)

Policy Element

The City shall require developers to turn over water rights, or cash in-lieu-of water rights, such that the total water supply available for municipal purposes is adequate to meet or exceed a 1-in-50 drought over the long term. Cash collected should be used to purchase additional water rights, acquire or develop additional storage capacity, or enter into other arrangements that will increase the long-term reliability of the City's supply system.

Discussion and Conclusions

The City's current raw water requirements provide new water rights, or cash in-lieu-of water rights, to keep up with City water demands that would occur during a 1-in-50 type drought event. Modeling the projected supplies and demands shows that water rights from the City's current portfolio plus additional rights acquired through the raw water requirements are adequate to meet future demand projections. With the addition of the new Pleasant Valley Pipeline, there is adequate capacity to carry water from the Poudre River to the water treatment facility. However, additional storage capacity in the water supply system is needed to meet future demands. Without additional storage capacity, it would take a significant increase in the raw water requirements to meet future demand levels.

Particular attention should be given to future water demands that require reusable sources. Because of the flexibility and value of reusable sources, opportunities of acquiring such water should be evaluated carefully.

The existing raw water requirements are sufficient to provide a supply of water for the City that will meet or exceed the 1-in-50 drought criteria during the planning period, provided that essential facilities are developed to make the supply available.

Strategies

(1) Continue to assess raw water requirements for new development to obtain water rights for future growth.
(2) Adjust the cash in-lieu-of rate as needed to obtain an appropriate mix of water rights and cash to achieve an adequate and reliable raw water supply system.
(3) Acquire sufficient reusable sources to meet future demands requiring such water.

7.2.3 Storage Capacity

Policy Element

The City will pursue the acquisition or development of storage capacity which is needed to manage the City's water rights in an efficient and effective manner and which will enhance the City's ability to get through at least a 1-in-50 drought. New storage capacity in the range of 12,500 to 14,000 acre-feet should be pursued to (1) help meet return flow obligations incurred from transfers of water rights from agricultural use to municipal use, (2) provide carryover water from wet years to dry years, and (3) provide operational flexibility, some redundancy, and reliability. Storage options include the enlargement of Halligan Reservoir, the development of local gravel pits into storage ponds, the acquisition of storage capacity in new or existing reservoirs, or some combination of the above.

Discussion and Conclusions

Computer modeling results show that additional storage capacity is needed to more effectively manage the variety of water rights that the City currently owns. The City currently owns and controls only 6,500 acre-feet of active storage capacity in Joe Wright Reservoir. This is inadequate to effectively regulate the wide variety of water rights the City owns.

As City demands grow and the City transfers more of its water rights from agricultural use to municipal use, the need for storage increases. New storage capacity in the range of 12,500 to 14,000 acre-feet is needed to (1) help meet return flow obligations incurred from transfers of water rights from agricultural use to municipal use, (2) provide carryover water from wet years to dry years and (3) provide operational flexibility and reliability. Return flow obligations require the ability to release water to the river year-around. Up to 2,000 acre-feet of storage is needed to store and release sufficient water to meet annual return flow obligations of many of the water rights owned by the City. Long-term carryover storage of approximately 12,000 acre-feet is needed to capture surplus water during wet and average years for use during drought periods. Storage capacity in the Poudre River Basin would also significantly improve the reliability of the City's raw water supply system in the event of a failure in the system. Finally, additional storage capacity would provide operational flexibility.

Storage options that are being studied and discussed include the enlargement of Halligan Reservoir, the development of local gravel pits into storage ponds and the acquisition of storage capacity in new or existing reservoirs. Some combination of these options would result in a more reliable system that better utilizes the City's existing and future portfolio of water rights.

Strategies

(1) Pursue acquisition or development of up to 2,000 acre-feet of operational storage capacity.

(2) Pursue acquisition or development of approximately 12,000 acre-feet of long-term carryover storage capacity.
(3) Enlarge Halligan Reservoir to provide carryover storage capacity.
(4) Acquire and convert gravel pits into operational storage reservoirs.
(5) Work with regional entities to evaluate and possibly participate in regional water supply and storage projects.

7.2.4 Use of Existing Supplies

Policy Element

The City will use its existing supplies to meet municipal obligations with the following priorities: (1) to meet water demands by the City's treated water customers, and (2) to meet raw water needs in the City and to meet other obligations of the City. Raw water needs include use for such purposes as irrigation of City parks, golf courses, cemeteries, and other greenbelt areas. Other raw water obligations include primarily water transfers to other entities because of agreements or exchanges made to manage the water supply system more effectively. Water not needed for the above purposes is referred to as surplus water and may be made available to others in accordance with decrees and other policies that may apply.

Discussion and Conclusions

City water supplies are used in many different ways. Foremost, they are used to meet the treated water needs of the City's customers within the Water Utility service area. Currently, approximately 31,000 acre-feet per year of treated water is used to meet the primary needs of Water Utility customers. Raw water is also needed to meet the needs of parks, golf courses, a cemetery and various greenbelt areas around Fort Collins. By providing raw water for these purposes, the cost of treatment and plant capacity is avoided. Other raw water obligations include water transfers to other entities to manage the water supply system more effectively.

Water supplies not needed for these primary purposes are often made available to farmers for irrigated agriculture and others that have a need for raw water. This water is usually referred to as surplus water and can be made available to others in accordance with decrees and other policies (see section 7.4).

Strategies

(1) Continue to meet the primary needs of municipal customers prior to providing water to other users.

7.3 Water Supply Shortage Response Plan

Policy Element

The City will maintain a plan for responding to situations where there are projected water supply shortages, either because of severe drought conditions or because of disruptions in the

raw water delivery system. This plan may include measures to temporarily reduce water use through media campaigns, various regulations, restrictions, rate adjustments and others. The plan may also include provisions to temporarily supplement the supply through interruptible water supply contracts, leases, exchanges and operational measures.

Discussion and Conclusions

Prior to the recent drought (2000-2003), the City did not have a written plan in place for responding to water supply shortages. In response to the severity of the drought year 2002, a plan was developed in the summer of 2002 and later revised and approved by City Council in April 2003 as Ordinance No. 048, 2003 (included as Appendix C). The plan dictates the steps to be taken in case the City experiences water supply shortages due to either drought or other emergency type shortages. Although the Utility's main objective is to provide customers with an adequate and reliable water supply, there will be times when the City's water supply is projected to be less than anticipated demands. In order to reduce water demands to a level that matches the short supplies, a response plan must be maintained to be able to act quickly and make the necessary adjustments.

The current plan contains four response levels based on the severity of the supply shortage. Depending on the response level, different actions are taken for each of the levels and include things such as setting restrictions for lawn watering, other landscape watering, outdoor washing activities, fountains and other water uses. The plan also discusses response level rate adjustments and fines for violating the restrictions. It is anticipated that this plan will be reviewed periodically and may be changed in the future to match the City's changing water supplies, facilities and operations.

Strategies

(1) Periodically review and maintain a water supply shortage response plan to proactively respond to supply shortages.

7.4 Use of Surplus Raw Water

Policy Element

To the extent the City has surplus raw water available after meeting the needs of its treated water customers and meeting other raw water obligations, it will make water available to entities or individuals at a fair rental market price that helps offset the City's cost of owning such supplies. Other objectives or uses of the surplus water include, in no particular order, providing irrigation water to farmers to provide for the continued production of agricultural crops in the Cache la Poudre River Basin and the Northern Colorado Water Conservancy District, helping maintain open space and natural areas supported by Fort Collins, and providing for other uses as opportunities arise.

Discussion and Conclusions

In order to maintain supplies that will meet dry year demands, the City has obtained water supplies in excess of average demands, producing surplus water in most years. After meeting the needs of City customers, the surplus water is currently made available to entities or individuals at a fair market price that helps offset the City's ownership costs. There are many competitors for the rental of this water, including agricultural users, municipal entities and other users of raw water.

The City of Fort Collins for many years has made its surplus raw water available to farmers around Fort Collins and within the Northern Colorado Water Conservancy District (NCWCD). The amount available varies considerably from year to year because of the City's demand, the annual variability in water yield and the demand from the agricultural community. The variability in both supply and demand are primarily affected by the precipitation throughout the year, both in the mountains and on the plains. The annual quota set by NCWCD for the CBT project water has a major effect on the total supply available to Fort Collins.

Prior to the recent drought years 2002 and 2003, the amount rented to other users has averaged just over 20,000 acre-feet per year. Most of this has been from three different sources. The rental of North Poudre Irrigation Company (NPIC) water has ranged from about 9,000 to 12,000 acre-feet per year. Rental of CBT water has ranged from about 3,000 to 10,000 acre-feet per year. Rental of Water Supply and Storage Company (WSSC) water has been about 2,000 acre-feet per year. The supply available and the rental demand vary each year by the type of water. The Water Utility has guidelines that are used as a tool in renting the City's surplus water. If there is adequate water from a given source to meet all the rental requests for that system, then all the requests are typically filled. When the surplus supply is sufficient to meet between approximately 70% and 100% of the amount requested, the City usually prorates the available supply for that system among requesters. If the requests are significantly more than the estimated surplus supply for a particular source, then a random allocation process is typically used to distribute the available supply. After the initial allocation of rental water, additional requests are usually met based on a first-come, first-served basis throughout the irrigation season as surplus water becomes available for rent.

The system of allocating surplus water has worked quite well in the past. Since the City needs a varying amount of water from year to year, it is desirable to have a rental system that does not encourage dependency on City water. It is also desirable to maintain considerable flexibility in order to effectively deal with the variability associated with the City's surplus rental water. Any proposal to dedicate some of the City's surplus water for specific uses should take into consideration the effects of such an action.

Strategies

(1) Continue to rent surplus water to farmers and others within the Poudre River Basin or the NCWCD on a year to year basis.

(2) When surplus supplies are short, allocate water in a manner that will not encourage renters to depend on City water.

7.5 Regional Cooperation

7.5.1 Working with Other Municipal Providers

Policy Element

The City will continue to work with the water suppliers throughout the Northern Colorado Front Range to assure that adequate supplies are maintained in the region. When benefits are identified, the City will cooperate with area entities in studying, building, and sharing capacity of water transmission lines, distribution systems, and storage reservoirs. Entities in this area that have many common interests with the City and which the City has the potential to cooperate with include the Soldier Canyon Filter Plant and the associated water districts, the City of Greeley and the Northern Colorado Water Conservancy District. In particular, the City should work closely with water districts that serve Fort Collins residents to encourage similar policies regarding drought protection and to provide mutual assistance during emergency situations.

Discussion and Conclusions

As growth continues in Fort Collins and the surrounding area, it is increasingly difficult to adopt policies or build projects without affecting one or more neighboring entity. Several water districts serve water inside the City boundaries. Policies made by the respective entities are compared with one another. Water rights are obtained from the same sources – either the Poudre River or the CBT Project. Facilities needed by different entities are side by side. Expertise and capabilities vary with each entity. There are opportunities to share facilities and knowledge, thereby reducing the cost to Utility customers.

The Tri-Districts (Fort Collins-Loveland, East Larimer County and North Weld County), which operate the Soldier Canyon Filter Plant, have much in common with Fort Collins Utilities. Both treat water from Horsetooth Reservoir and have a need to develop additional sources from the Poudre River. Their transmission lines traverse through the City adjacent to many of Fort Collins Utilities' pipelines. West Fort Collins Water District (WFCWD) presently turns over raw water to the Water Utility, where it is treated and then returned to WFCWD for distribution. The City of Greeley diverts water from the Poudre River and has several storage reservoirs in the Poudre River Basin. NCWCD provides CBT water to all the local water users and has a leadership role in many water planning and management issues. Several groups such as the Larimer-Weld Water Issues Group (LWWIG) and the group studying the Northern Integrated Supply Project (NISP) have been formed to share information and pursue common goals.

The relationship between the City and other municipal water providers becomes increasingly important as growth in the Poudre River Basin increases. Sharing facilities with these entities may provide regional benefits and cost savings for all customers.

Strategies

(1) Continue to cooperate with the Tri-Districts regarding the sharing of treated water and conveyance through common pipelines.
(2) Work towards more uniform policies regarding raw water requirements among the Utility and local water districts that serve residents of the City of Fort Collins.
(3) Continue to work closely with Greeley, NCWCD and the Tri-Districts on Poudre River Basin modeling efforts.
(4) Monitor, provide input and be involved as necessary in regional supply projects.
(5) Continue participation in regional groups for information exchange and to identify opportunities for cooperation.

7.5.2 Working with Local Irrigation Companies

Policy Element

The City will continue to cooperate with local irrigation companies regarding the transfer, exchange and use of water in the Cache la Poudre River Basin. As a major shareholder in many of the local irrigation companies, it is necessary and desirable that the City work closely with these companies.

Discussion and Conclusions

The Water Utility currently owns a significant number of shares in several local irrigation companies, including NPIC, Pleasant Valley and Lake Canal Company, Arthur Irrigation Company, Larimer County Canal No. 2 Irrigation Company, New Mercer Ditch Company and WSSC, among others. Besides owning shares of these companies, the City regularly cooperates to maximize the efficient use of Poudre River Basin water by participating in exchanges and transfers. The manner in which the City uses shares can significantly affect the operations of these companies, especially when the water is changed from agricultural to municipal use. City staff members serve on the board of directors for some of these companies, helping to make important decisions regarding the operation of the companies.

Maintaining a good relationship between the City and the local irrigation companies is important in managing the supplies in the Poudre River Basin. Continued cooperation with these companies provides benefits to the City, the agricultural community and the Poudre River Basin as a whole.

Strategies

(1) Continue to cooperate with local irrigation companies regarding the transfer, exchange and use of water in the Poudre River Basin.
(2) Continue to participate as board members and/or shareholders in local irrigation companies.

7.5.3 Transferring Water Rights from Agricultural to Municipal Use

Policy Element

The City will periodically transfer its water rights from agricultural use to municipal use on those shares that come from areas upon which the City is growing, or from shares where the irrigation of such lands has ceased. For water rights that were derived from irrigated agricultural lands that remain in viable agricultural areas, the City may transfer these water rights to municipal use when a need is identified or other factors make it prudent to do so. To the extent that this water remains surplus to the City's need, the City will continue to support the local agricultural economy by renting this surplus agricultural water back to irrigators under the respective irrigation companies.

Discussion and Conclusions

Many of the water rights that the City owns are in the form of irrigation company shares. These shares must be converted through Water Court in order to use them for municipal purposes. Some of these shares come from areas where the City is growing or from shares where the irrigation of such lands has ceased. However, some of the shares obtained are from irrigated agricultural lands that remain in production. Due to population growth in the area and subsequent rises in water prices, more and more irrigation share owners desire to sell their water rights and remain in business by renting the water needed for their operations. Although these water users lose the certainty of receiving water via ownership, those who sell their shares can often receive high prices and then rent water for a relatively low cost. Converting irrigation shares to municipal use may reduce the amount of water available for rental and potentially drive some agricultural renters out of business.

In order to follow the Water Utility's objective of providing water for the needs of its primary customers, the City will need to periodically transfer its water rights from agricultural use to municipal use. Shares obtained from areas where the City is growing or from shares where irrigation has ceased do not appear to be detrimental to the agricultural community, and therefore could be converted when necessary. However, the City should be sensitive to the effect it has on the local agricultural community when considering the conversion of water shares from agricultural lands still in production.

Strategies

(1) Convert shares from agricultural use to municipal use as needed or at opportune times, taking into consideration the effect on the local agricultural community.

7.6 Raw Water Quality

Policy Element

The City will take a proactive role in protecting the quality of water in the various watersheds from which the City's raw water is derived. The acquisition, development, and management of

the City's raw water will be consistent with the City's Drinking Water Quality Policy and other applicable policies related to watershed protection.

Discussion and Conclusions

The quality of the water sources that the City provides its customers is of great importance. Due to Fort Collins' proximity to the mountains, where the majority of the water supply originates, the quality of the raw water is relatively high. The quality of treated water produced by the City is addressed in the City's current Drinking Water Quality Policy (Resolution 93-144).

Watershed forums are forming and becoming active in promoting actions to protect the quality of the raw water in local rivers and streams. The Utility has a long standing commitment to providing customers with high quality water.

Strategies

(1) Maintain the City's high quality water sources, both raw and treated, by continuing to follow the guidelines established in the City's Drinking Water Quality Policy.
(2) Actively participate in and promote protection of water quality in the respective watersheds from which the City receives its water supplies.

7.7 Stream Flow and Ecosystem Protection

Policy Element

To the extent the City's use of its water rights and water resources are not adversely affected, the City will cooperate with other local groups or agencies to encourage flows in local streams to protect the ecosystem, in accordance with Colorado water law and the administration of water rights in Colorado.

Discussion and Conclusions

In recent years, Colorado has seen an increase in demand for in-stream flows for protection of ecosystems in and around rivers and streams. Dedication of City water for these purposes could result in a reduction of the amount of supplies available to meet the water needs of City customers. There may, however, be opportunities where the City can participate in managing flows in the river that would benefit the ecosystem while not affecting the supplies needed to meet City customer demands.

If consistent with other objectives of the Water Utility, the City should cooperate with other local groups or agencies to encourage minimum flows in local streams to protect the ecosystem. These actions must be in accordance with Colorado water law and the administration of water rights in Colorado.

Strategies

(1) Be receptive to opportunities to cooperate with others to provide minimum flows to help protect the ecosystem.

7.8 Recreational/Aesthetic Flows

Policy Element

To the extent the City's use of its water rights and water resources are not adversely affected, the City will cooperate with other local groups or agencies to explore projects or measures that would provide flows in streams and water in reservoirs for recreational and aesthetic purposes, in accordance with Colorado water law and the administration of water rights in Colorado.

Discussion and Conclusions

In recent years, Colorado has seen an increase in the demand for in-stream flows for recreational purposes and aesthetic beauty. As with ecosystem protection, dedication of water for these purposes could result in a reduction of the amount of water available to meet customer demands. However, it may be possible to manage water supplies such that it will provide recreational benefits to the citizens of Fort Collins without affecting the supplies needed for agricultural, municipal and industrial uses.

If consistent with other objectives of the Water Utility, the City should cooperate with other local groups or agencies to encourage minimum flows in local streams for recreational/aesthetic purposes. These actions must be in accordance with Colorado water law and the administration of water rights in Colorado.

Strategies

(1) Be receptive to opportunities to cooperate with others to provide minimum flows to provide recreational benefits without affecting City supplies.

Appendix A

1988 Water Supply Policy

RESOLUTION 88-205
OF THE COUNCIL OF THE CITY OF FORT COLLINS
ADOPTING A WATER SUPPLY POLICY

WHEREAS, the City's population and water demands are expected to continue to grow during the next several decades; and

WHEREAS, increased competition and speculation for water resources is anticipated along the Northern Colorado Front Range; and

WHEREAS, during the past two years the City Staff and Water Board have extensively studied the City's present and future water supply needs and have proposed changes regarding the City's water supply policy; and

WHEREAS, the Water Board, after considerable study and debate, has made a recommendation to adopt a water supply policy which can be used for future planning and water acquisition programs; and

WHEREAS, a joint City Council and Water Board Committee was appointed in February 1988 to examine a number of key issues related to the City's proposed water supply policy; and,

WHEREAS, the joint Council/Water Board Committee, after much deliberation, made several recommendations regarding water supply reliability, acquisition, and financing; and

WHEREAS, the Water Board has suggested that the Committee's recommendations be adopted by City Council; and

WHEREAS, the Council finds that this water supply policy and subsequent actions will result in a more reliable water supply and will result in significant long-term benefits to the citizens of the City.

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FORT COLLINS as follows:

Section 1. That the following water supply policies be adopted:

1. Cooperation with Agricultural Community. The City should continue to be sensitive to the effects that City acquisition policies have on the agricultural community.

2. Reliability of Supply. The reliability of the Fort Collins water supply should be maintained to meet at least the 1 in 50 drought event.

3. Timing of Acquisitions. Water supplies that help balance the City's present raw water system should be acquired ahead of the time it is needed to meet the 1-in-50 reliability criteria.

4. Process of Acquiring Water Rights and Storage. The City should evaluate opportunities as they arise and obtain the most desirable sources of water. These opportunities may include acquisition of water stock or CBT water, lease arrangements, and the development or rehabilitation of reservoirs.

5. Raw Water Requirements for New Development. The raw water requirements (RWR) for new development should be set such that with other water acquisitions, the total water supply available is adequate to meet or exceed a 1-in-50 drought over the long term.

6. Regional Participation/Cooperation. The City should continue to work with the water suppliers throughout the Northern Colorado Front Range region to assure that adequate supplies are maintained in the region and that maximum use is obtained from supplies and available infrastructure (treatment capacity and transmission lines).

7. Demand Management. Water conservation education programs should be continued and enhanced so as to encourage efficient water use. Plans should be made to provide adequate treatment plant capacity to meet projected peak day demands without imposing restrictions.

Section 2. That Water Board and City Staff shall use the foregoing policies as general criteria when considering water supply projects, acquisition of water rights, and other measures related to the City's water supply.

Section 3. That Staff be directed to present to City Council appropriate resolutions and ordinances, and take other measures as necessary, to implement the following actions as recommended by the joint City Council and Water Board Committee:

1. Increase the raw water requirements for new development by approximately 20%.

2. Purchase 7,400 acre feet of water over the next five years with funds generated from general water service fees.

3. Increase water service fees by 3% in 1989, 3% in 1990, and 2% in 1991 to finance the purchase of 7,400 acre feet of water.

4. Take steps necessary to optimize existing water treatment plant capacity and plan for future water treatment plant expansions that will meet projected demands without imposing restrictions.

Passed and adopted at a regular meeting of the Council of the City of Fort Collins held this 20th day of December, 1988.

Mayor

ATTEST:

City Clerk

Appendix B

1992 Water Demand Management Policy

RESOLUTION 92-63
OF THE COUNCIL OF THE CITY OF FORT COLLINS
ADOPTING A WATER DEMAND MANAGEMENT POLICY

WHEREAS, the Council of the City of Fort Collins has previously determined that it is in the best interest of the City that a Water Demand Management Committee review the current policies and practices of the City regarding water demand management and to make recommendations regarding any suggested changes; and

WHEREAS, the Council created said committee with Resolution 90-24, dated February 20, 1990; and

WHEREAS, the Water Demand Management Committee, after extensive review and discussion, has made a recommendation to augment the water supply policy, created by Resolution 88-205, dated December 20, 1988, with the adoption of this water demand management policy; and

WHEREAS, the proper use of the resource of water is essential in maintaining the public health, safety and welfare; and

WHEREAS, the City of Fort Collins has historically placed primary emphasis on water supply and has previously adopted a policy to maintain a supply sufficient to meet the demand during a 1 in 50 year type drought; and

WHEREAS, water is a limited and vital resource which must be used efficiently and wisely; and

WHEREAS, water conservation should be an integral part of a long-term water supply and demand management program; and

WHEREAS, the implementation of additional conservation practices will benefit the City of Fort Collins by helping to assure continued reliable short and long term supplies of high quality, reasonably-priced water.

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FORT COLLINS as follows:

Section 1. That the following water demand management policies be adopted:

1. Project a water conservation "ethic". The City should initiate and intensify activities that demonstrate a commitment to the efficient and wise use of water.

2. Public education. The community's awareness of the importance of using water efficiently should be reinforced and strengthened.

3. Defer water treatment plant expansion. Deferring expansion of the water treatment plant--without jeopardizing future needs--should be a goal of water demand management.

4. Permitting compliance. Water use efficiency within the city should be improved in order to ensure compliance with anticipated federal

and state permitting requirements for water-use efficiency, applicable to future supply expansion projects.

5. Appearance of landscaping. The attractive appearance of the community's public and private landscapes should be maintained and encouraged.

Section 2. That the following water demand management goals be adopted:

1. Improve, document, and publicize the City government's water use efficiency, such that we can encourage the public through positive leadership.

2. Lower the adjusted per capita peak daily demand from the current 605 gpc to 575 gpc by the year 1996 (5% reduction), 545 gpc by the year 2000 (10% reduction), and 502 gpc by the year 2010 (17% reduction).

3. Lower the adjusted per capita annual consumption from the current 235 gpcd to 223 gpcd by the year 1996 (5% reduction), 211 gpcd by the year 2000 (10% reduction), and 195 gpcd by the year 2010 (17% reduction).

4. Review progress in meeting goals and objectives on an annual basis, and make adjustments as necessary.

Section 3. That, in order to meet the above-stated goals, staff is hereby directed to implement the following measures, as recommended by the Water Demand Management Committee, and take such other actions as may be reasonably necessary to accomplish such goals:

1. Implement an ongoing leak detection program.

2. Perform an audit of indoor water use at City-owned facilities, and install more water-efficient plumbing fixtures, where determined to be cost-effective.

3. By the end of 1994, install meters on all City department water taps, and assess 100% of the associated water and wastewater service charges. Additionally, assess City departments that rent water at 100% of the current rental rate.

4. Institute a more aggressive, comprehensive and visible public education campaign on water conservation.

5. Research all irrigated City-owned landscapes for the possibility of converting from potable to raw water, and implement where it is determined to be economically justified.

6. Provide an annual training program on efficient watering for all City employees and contract laborers that are involved with irrigation of City-owned landscapes.

7. Institute a voluntary certification program for sprinkler contractors, with the qualification being the satisfactory completion of a test on water-efficient irrigation design.

8. Amend the residential and non-residential Point Charts within the Land Development Guidance System to include water-conserving actions in the awarding of points.

9. Develop minimum water conservation standards for irrigation systems associated with landscape plans for all development which is subject to City review and approval. This does not include the irrigation systems of single family residences.

10. Where determined to be financially justified for individual City departments, implement central irrigation control for irrigated City-owned landscaping.

11. Develop guidelines for the design of City-owned landscaping, with a high priority being placed on water conservation and Xeriscape landscaping.

12. Develop a zero-interest loan program for the installation of qualified water conservation measures, as specified by Water Utility Staff and Water Board.

Passed and adopted at a regular meeting of the Council of the City of Fort Collins held this 7th day of April, A.D. 1992.

Susan Kirkpatrick
Mayor

ATTEST:

Wanda M. Krajicek
City Clerk

Appendix C

Water Supply Shortage Response Plan

ORDINANCE NO. 048, 2003
OF THE COUNCIL OF THE CITY OF FORT COLLINS
SUPERCEDING EMERGENCY ORDINANCE NO. 112, 2002,
TO PRESCRIBE TEMPORARY RESTRICTIONS ON AND
REQUIREMENTS FOR THE USE OF CITY TREATED WATER
PURSUANT TO A WATER SUPPLY SHORTAGE RESPONSE PLAN
TO BE EFFECTIVE APRIL 11, 2003

WHEREAS, on July 16, 2002, the City Council adopted Emergency Ordinance No. 112, 2002, which prescribed certain restrictions on the use of City-treated water for lawn watering, in view of the current conditions and projections for future municipal water supplies in Fort Collins; and

WHEREAS, on September 3, 2002, the Council adopted on second reading Ordinance No. 118, 2002, amending Emergency Ordinance No. 112 to increase the time allowable for watering of new sod and seeded areas, and to make other clarifying changes; and

WHEREAS, on September 17, 2002, the continued drought conditions in the region had resulted in increased concerns regarding future municipal water supplies for Fort Collins and, as a result, the Council adopted on second reading Ordinance No. 135, 2002, which limited lawn watering with City-treated water to one day per week, as of September 27, 2002; and

WHEREAS, Ordinance No. 112, 2002, as amended by Ordinance No. 118 and Ordinance No. 135, continues in effect as of the time of this Ordinance; and

WHEREAS, in light of the continued threat of drought conditions in Fort Collins, and the evolving condition of the City's municipal water supply and the information related thereto, the City Council desires to establish a system by which water use restrictions shall be determined administratively; and

WHEREAS, the City Manager has recommended that the City Council adopt a four-tier Water Supply Shortage Response Plan, attached hereto as Exhibit "A" and incorporated herein by this reference (the "Response Plan"), which upon adoption by the Council will provide a system of water supply shortage response levels and corresponding water restrictions and conservation measures to be implemented administratively based on the projected water supply shortage; and

WHEREAS, the City Council has determined that the adoption of the Response Plan will enable the City Manager to respond appropriately to changing water supply conditions based on the Council's directions set forth therein.

NOW, THEREFORE, BE IT ORDAINED BY THE COUNCIL OF THE CITY OF FORT COLLINS as follows:

Section 1. As of April 11, 2003, Ordinance No. 112, 2002, as amended, shall be superceded by the terms of this Ordinance.

Section 2. The City Manager is hereby authorized to determine, based upon the most current available estimated water supplies available to the City, water consumption data, and climatological forecasts, the projected water supply shortage for Fort Collins. The City Manager is further authorized and directed to declare, based on that determination, the appropriate Water Supply Shortage Response Level, as set forth in the Response Plan attached hereto as Exhibit "A". Upon such determination and declaration, the City Manager shall cause to be published in the local newspaper of record a notice of the restrictions and requirements corresponding to that Water Supply Shortage Response Level, as set forth herein, and the effective date of said restrictions and requirements, which shall be no more than fourteen (14) days and no fewer than ten (10) days after the date of such declaration. The City Manager shall inform the City Council promptly of any such determination and declaration.

Section 3. The following terms shall be defined as set forth herein for the purposes of this Ordinance:

A. "Lawn watering" shall mean the use of treated or potable water obtained from the City to irrigate or water any lawn, grass or turf areas, but shall not include:

i. irrigation or watering of flowers, flower beds, trees, shrubs, or vegetable gardens; or

ii. irrigation or watering of lawn, grass or turf areas with privately owned well water or raw water, provided that the user of any such well or raw water for irrigation or watering within the service area of the city water utility has posted a public notice of the same in the watering location in a manner visible from the street.

B. "Dealership vehicle" shall mean any unregistered vehicle on display or awaiting sale by a vehicle dealer or other person holding or selling vehicles in the normal course of business.

C. "Designated landing area" shall mean that area of any golf course hole that is determined by the Utilities General Manager, in consultation with such other officials and experts as he or she deems appropriate, to constitute the portion of said golf course hole in which golf balls hit by the average golfer on said hole will land.

D. "Health and safety reasons" shall mean as reasonably necessary to remedy an accidental or unavoidable unsanitary or dangerous condition that poses an immediate health risk or danger to the public or to the occupants of a particular property. The spraying of impervious surfaces for *health and safety*

reasons shall only be permitted in the event that the unsanitary or dangerous condition may only reasonably be remedied by the use of sprayed water.

E. "Landscape watering" shall mean the use of treated or potable water obtained from the City to irrigate or water any flowers, flower beds, trees, shrubs, vegetable gardens, or other landscaped plantings or plants, but shall exclude *lawn watering*, as defined herein.

F. "Low-volume efficient irrigation" shall mean an irrigation system that includes only bubblers, drip emitters, soaker hoses and subsurface irrigation such as deep probe irrigation, as well as micro-spray irrigation.

G. "Medical hardship" shall mean an exceptional hardship imposed upon an individual residential customer by the restrictions set forth in this Ordinance.

H. "Private" shall mean not *public*.

I. "Public" shall mean operated for use by the general public or publicly owned and operated.

J. "Religious objection" shall mean an objection to the specific application of the requirements of this Ordinance due to a conflicting religious belief that precludes watering on an assigned day.

K. "Residential" shall mean a single-family or duplex residential property or account.

L. "Spraying impervious surfaces" shall mean rinsing, washing or spraying with a hose impervious interior or exterior surfaces, including but not limited to surfaces such as garage floors, siding, windows, sidewalks, driveways, or patios. The term *spraying impervious surfaces* shall not mean powerspraying of painted surfaces to remove paint.

M. "Sprinkler system maintenance" shall mean the operation of an automatic watering system to the extent reasonably necessary for repair or maintenance.

N. "Water fountain" shall mean a water feature that either causes water to be sprayed into the air, or is a waterfall or fountain for public display. The term *water fountain* shall not mean a water feature of a pond or basin that performs a function essential to the support of fish life in that pond or basin.

Section 4. When the City Manager has declared the City to be in a specified Water Supply Shortage Response Level condition, it shall be unlawful, and a violation of the terms and conditions upon which the City shall provide treated water to its customers, for any person to undertake or permit activities or use of City-treated water in a violation of the water restrictions and requirements associated with that particular Response Level, as set forth in Exhibit "A".

Section 5. Each person, including any natural person, entity, organization, partnership, association or joint venture, with legal or actual control of any property, business or other establishment, water account, or water system serving any of the same, shall have an affirmative duty to cause said property, business or other establishment, water account, or water system to operate and act in a manner consistent with the restrictions and requirements of this Ordinance.

Section 6. In the event that the Utilities General Manager determines that a permit application meets the applicable eligibility requirements, then he or she shall issue a permit for lawn watering containing such terms and conditions as he or she determines, in his or her reasonable discretion, will allow the minimum watering necessary to carry out the intent of the permit. The Utilities General Manager may, in determining said permit terms and conditions, consider the impacts of the permitted lawn watering on the City's water supply or water system operations. Any determination of the Utilities General Manager hereunder shall be issued within five (5) business days of the submission of a complete application, shall be provided in writing to the applicant, and shall include an explanation of the basis for any determination of denial.

Section 7. A written determination by the Utilities General Manager under Section 6 may be appealed to City Manager, provided that notice of any such appeal shall be filed in writing within five (5) days of issuance of the same and shall include an explanation of the basis for the appeal. The City Manager may conduct such investigations as he or she determines appropriate or necessary to determine whether the decision appealed was arbitrary or capricious or otherwise inconsistent with the terms of this Ordinance, and shall issue a written explanation of his or her decision on any appeal within ten (10) days of the submission of a sufficient notice of appeal.

Section 8. Use of City treated water in violation of this Ordinance or in violation of a permit issued hereunder shall constitute a violation of City Code Section 26-51, which authorizes the discontinuation of water service in the event of use of water for purposes not authorized.

Section 9. Violation of the terms of this Ordinance in the city or violation of the terms of a permit issued hereunder shall be deemed to constitute a violation of the City Code pursuant to City Code Section 1-15(a), and shall be punishable as set forth therein, except that notwithstanding the provisions of Section 1-15(a), fines for violations of this Ordinance shall be as follows:

A. Residential Violations

i. Violation of any provision of this Ordinance or permit issued hereunder on or for a residential property or use shall be punishable by a minimum fine of fifty dollars ($50) per violation up to a maximum fine of one thousand dollars ($1,000) per violation, if the

violation occurs during a Response Level 1 or Response Level 2 condition.

ii. Violation of any provision of this Ordinance or permit issued hereunder on or for a residential property or use shall be punishable by a minimum fine of one hundred dollars ($100) per violation up to a maximum fine of one thousand dollars ($1,000) per violation, if the violation occurs during a Response Level 3 or Response Level 4 condition.

B. Non-Residential Violations

i. Violation of any provision of this Ordinance or permit issued hereunder on or for any property or use other than a residential property or use shall be punishable by a minimum fine of two hundred and fifty dollars ($250) per violation up to a maximum fine of one thousand dollars ($1,000) per violation, if the violation occurs during a Response Level 1 or Response Level 2 condition.

ii. Violation of any provision of this Ordinance or permit issued hereunder on or for any property or use other than a residential property or use shall be punishable by a minimum fine of five hundred dollars ($500) per violation up to a maximum fine of one thousand dollars ($1,000) per violation, if the violation occurs during a Response Level 3 or Response Level 4 condition.

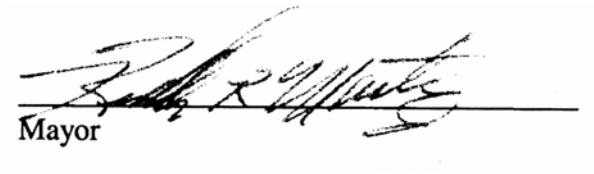
C. Each day during which a violation of any provision of this Ordinance or permit issued hereunder occurs or continues shall constitute a separate misdemeanor offense under this Ordinance.

Section 10. The City Manager is hereby directed to present to the Council for consideration a revised water rate structure to reflect revised consumption and revenue projections as soon as reasonably practicable after a change in the Water Supply Shortage Response Level.

Section 11. The City Manager shall conduct the business of the City in a manner consistent with applicable provisions of the Water Supply Shortage Response Plan.

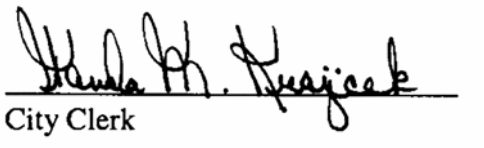
Section 12. This Ordinance shall remain in effect until such time as the City Council determines that municipal water supply conditions no longer justify the continued implementation of the Water Supply Shortage Response Plan.

Introduced, considered favorably on first reading, and ordered published this 25th day of March, A.D. 2003, and to be presented for final passage on the 1st day of April, A.D. 2003.



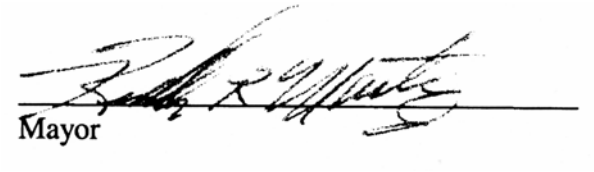
Mayor

ATTEST:



City Clerk

Passed and adopted on final reading this 1 day of April, A.D. 2003.



Mayor

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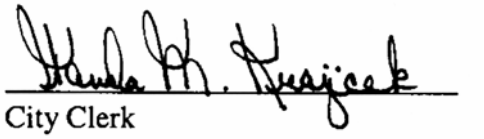


City Clerk

Water Supply Shortage Response Plan

March 20, 2003

	Response Level 1	Response Level 2	Response Level 3	Response Level 4
Water Supply				
Projected water supply shortage as determined by the City Manager	1-10%	11-20%	21-30%	Greater than 30%
Regulated Water Use Activities				
1. Lawn & turf watering				
a. Non-watering hours	No lawn watering between 10 a.m. to 6 p.m.	No lawn watering between 10 a.m. to 6 p.m.	No lawn watering between 10 a.m. to 6 p.m.	No lawn watering between 10 a.m. to 6 p.m.
b. Number of watering days per week (Note: even and odd refers to the street address)	Residential (even) - Th & Sun Residential (odd) - Wed & Sat Multi-family & Commercial - Tue & Fri No watering on Monday.	Residential (even) - Sun Residential (odd) - Sat Multi-family & Commercial - Fri No watering Monday thru Thursday.	Residential (even) - Sun Residential (odd) - Sat Multi-family & Commercial - Fri No watering Monday thru Thursday.	No watering from 6/1 thru 8/31. Use Level 3 restrictions from 9/1 thru 5/31.
c. Time limit per day	Unrestricted during watering hours	Unrestricted during watering hours	2 hours during designated watering day	No watering from 6/1 thru 8/31. Use Level 3 restrictions from 9/1 thru 5/31.
d. Sprinkler system maintenance	Allowed any time. Minimize water used.	Allowed any time. Minimize water used.	Allowed any time. Minimize water used.	Allowed only from 9/1 thru 5/31. Minimize water used.
2. Lawn & turf watering exceptions by permit	(Note: All permits must be displayed so they are visible from the street or sidewalk.)			
a. Sod and seed for new lawns	Permit required to water other than normal watering days for a period not to exceed 3 weeks for sod and 4 weeks for seed.	Permit required to water other than normal watering day for a period not to exceed 3 weeks for sod and 4 weeks for seed.	No exceptions from 5/15 thru 8/15. Permit required to water other than normal watering day for a period not to exceed 3 weeks for sod and 4 weeks for seed that is installed from 8/16 thru 5/14.	No exceptions
b. Medical hardship	Permit required for a special watering schedule to accommodate medical hardship. No watering on Monday and between the hours of 10 a.m. and 6 p.m.	Permit required for a special watering schedule to accommodate medical hardship. No watering on Monday thru Thursday and between the hours of 10 a.m. and 6 p.m.	Permit required for a special watering schedule to accommodate medical hardship. No watering on Monday thru Thursday and between the hours of 10 a.m. and 6 p.m. Must comply with 2 hr/week restriction.	No exceptions
c. Religious objection	Permit required to accommodate a different two-day schedule. No watering on Monday and between the hours of 10 a.m. and 6 p.m.	Permit required to accommodate a different watering day. No watering Monday thru Thursday and between the hours of 10 a.m. and 6 p.m.	Permit required to accommodate a different watering day. No watering Monday thru Thursday and between the hours of 10 a.m. and 6 p.m. Must comply with 2 hr/week restriction.	No exceptions

	Response Level 1	Response Level 2	Response Level 3	Response Level 4
d. 4 acres or more	Permit required for a special watering schedule to accommodate areas of 4 acres or more. Max of 1.00" per week. No watering on Monday and between the hours of 10 a.m. and 6 p.m.	Permit required for a special watering schedule to accommodate areas of 4 acres or more. Max of 0.75" per week. No watering Monday thru Thursday and between the hours of 10 a.m. and 6 p.m.	No exceptions	No exceptions
e. City parks & public athletic/playing fields using treated water	Permit required for a special watering schedule. Max of 1.25" per week. No watering on Monday and between the hours of 10 a.m. and 6 p.m.	Permit required for a special watering schedule. Max of 1.00" per week. No watering Monday thru Thursday and between the hours of 10 a.m. and 6 p.m.	Permit required for a special watering schedule for only select fields. Max of 0.75" per week. No watering Monday thru Thursday and between the hours of 10 a.m. and 6 p.m.	No exceptions
f. Golf courses using treated water	Permit required for special watering schedule- No watering rough. No watering between the hours of 10 a.m. and 6 p.m.	Permit required for special watering schedule- No watering rough. No watering between the hours of 10 a.m. and 6 p.m.	Permit required for special watering schedule. Max of 0.75" per week for tees, greens & designated landing areas. No watering between the hours of 10 a.m. and 6 p.m.	Permit required for special watering schedule. Max of 0.75" per week for tees and greens. No watering between the hours of 10 a.m. and 6 p.m.
g. Well or raw water	Registration recommended - unrestricted use	Registration recommended - unrestricted use	Registration recommended - unrestricted use	Registration recommended - unrestricted use
3. Landscape watering (trees, shrubs, gardens)	Unrestricted	Water by hose with shutoff nozzle or low-volume efficient irrigation.	Water by hose with shutoff nozzle or low-volume efficient irrigation.	Water by hose with shutoff nozzle or low-volume efficient irrigation.
4. Non-automated car washing	Shutoff nozzle and bucket required.	Shutoff nozzle and bucket required.	Not allowed from 6/1 thru 8/31. Shutoff nozzle and bucket required 9/1 thru 5/31.	Not allowed
5. Washing City fleet vehicles	Once per week or as approved by the City Manager for health or safety reasons.	Once per month or as approved by the City Manager for health or safety reasons.	Not allowed unless approved by the City Manager for health or safety reasons.	Not allowed unless approved by the City Manager for health or safety reasons.
6. Dealership vehicle washing	Once per week	Once per week	Upon sale	Upon sale
7. Spraying impervious surfaces (siding, garages, sidewalks, driveways, patios) except as necessary for health and safety reasons	Not allowed	Not allowed	Not allowed	Not allowed

	Response Level 1	Response Level 2	Response Level 3	Response Level 4
8. Hydrant flushing & testing	Unrestricted	Limited to critical situations as approved by the Utilities General Manager.	Limited to critical situations as approved by the Utilities General Manager.	Limited to critical situations as approved by the Utilities General Manager.
9. Water Fountains Public Display Private	 No use allowed Unrestricted	 No use allowed No use allowed	 No use allowed No use allowed	 No use allowed No use allowed
Enforcement				
1. Residential fines per violation	$50 to $1,000	$50 to $1,000	$100 to $1,000	$100 to $1,000
2. Business fines per violation	$250 to $1,000	$250 to $1,000	$500 to $1,000	$500 to $1,000
Water Rate Adjustments				
Adjust water rates to encourage additional conservation	No adjustment	Recommend adjustment that reflects a 15% reduction in water demand.	Recommend adjustment that reflects a 25% reduction in water demand.	Recommend adjustment that reflects a 35% reduction in water demand.

Appendix D

Water Supply and Demand Management Policy

RESOLUTION 2003-104
OF THE COUNCIL OF THE CITY OF FORT COLLINS
ADOPTING A WATER SUPPLY AND DEMAND
MANAGEMENT POLICY

WHEREAS, a Water Supply Policy was adopted by the City Council in December 1988 to help direct the acquisition, development, and management of the City's water supplies since that time; and

WHEREAS, a Water Demand Management Policy was adopted by the City Council in April 1992, which set water use goals and provided for measures to help meet those goals; and

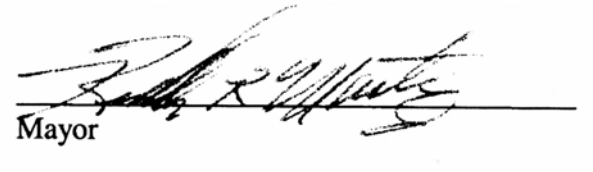
WHEREAS, there is a need to update the water supply and demand management policies to provide guidance regarding the future development and use of the City's water supplies; and

WHEREAS, the Council has requested that staff develop an integrated water supply and demand management policy; and

WHEREAS, the Fort Collins Water Supply and Demand Management Policy attached hereto as Exhibit "A" and incorporated herein by this reference has been developed over the last several years through discussions with interested citizens, groups, the Water Board and City Council.

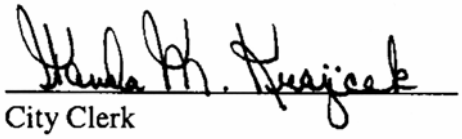
NOW THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE CITY OF FORT COLLINS that the City Council hereby adopts the Fort Collins Water Supply and Demand Management Policy attached hereto, to provide general criteria for City decision making regarding water supply projects, acquisition of water rights, and demand management measures.

Passed and adopted at a regular meeting of the Council of the City of Fort Collins held this 16th day of September, A.D. 2003.



Mayor

ATTEST:



City Clerk

EXHIBIT "A"

Fort Collins Water Supply and Demand Management Policy
September 16, 2003

Policy Objective: To provide a sustainable and integrated approach to (1) providing an adequate and reliable supply of water for the beneficial use by customers and the community and (2) managing the level of demand and the efficient use of a scarce and valuable resource.

1. Demand Management

a. Water Use Goals. The City will implement the necessary water conservation practices and programs to reduce its water use to an average of 185 gallons per capita per day (gpcd) by the year 2010. In addition, the per capita peak daily demand will be reduced to 475 gpcd by the year 2010. These calculations are based on the total treated water produced for use by City customers (adjusted for large contractual customers and other sales or exchange arrangements) divided by the estimated population of the City's water service area.

b. Educational Programs. The City will have a continuous, comprehensive and visible public education program that helps citizens and businesses use water appropriately and efficiently. Examples of such programs include (1) working with the schools to provide water conservation education, (2) promoting the use of xeriscape landscaping for public facilities, businesses, homeowners, and others, (3) helping the public to understand and utilize evapo-transpiration information in determining their irrigation applications, and (4) educating water users on the operation of sprinkler system controllers.

c. Rate Structures. The City will have water rate structures for all classes of customers that provide an economic incentive to use water efficiently. Examples of structures that may be utilized include (1) tiered structures with increasing prices as water use increases, (2) seasonal blocks with higher rates during the irrigation season, (3) water budget approaches based on appropriate targets for individual customers, and (4) flat rate structures.

d. Incentive Programs. When determined to be cost effective, the City will implement incentive programs that will assist customers in replacing outdated plumbing fixtures or landscape features that use excessive amounts of water. Examples for reducing indoor use are rebates for replacing showerheads, toilets and clothes washers with water conserving models. Examples for reducing outdoor use include rebates for expenses related to irrigation scheduling equipment and converting landscape to xeriscape.

e. Regulatory Measures. The City will maintain and/or adopt regulations that promote water efficiency and reduction of water waste while recognizing the benefits of adequate water to maintain an attractive and pleasant environment in the City. Examples include regulations that require the amendment of soils with organic materials and prohibition of homeowner associations banning the use of xeriscape. The City will also review its Land Use Code for potential revisions which would limit bluegrass turf on new landscapes and prohibit landscaping that requires irrigation in certain areas such as medians, thin strips, and other small areas.

f. Operational Measures. The City will establish practices and procedures to deliver and use water in its facilities without excessive losses. Examples of such practices are the leak detection program to reduce losses through the Utility's water distribution system and the recycling of backwash water at the Water Treatment Facility.

2. Water Supply for Municipal Use

a. Drought Criteria. The reliability of the Fort Collins water supply should be maintained to meet at least the 1-in-50 year drought event in the Cache la Poudre River Basin. Water rights and storage capacity should be acquired ahead of the time it is needed to meet at least the 1-in-50 year drought criteria, so as to provide enough time to seek and obtain water court decrees and diversion or storage facilities, if needed, to use such water.

b. Raw Water Requirements (RWR). The City shall require developers to turn over water rights, or cash in-lieu-of water rights, such that the total water supply available for municipal purposes is adequate to meet or exceed a 1-in-50 year drought over the long term. Cash collected shall be used to purchase additional water rights, acquire or develop additional storage capacity, or enter into other arrangements that will increase the long-term reliability of the City's supply system.

c. Storage Capacity. The City will pursue the acquisition or development of storage capacity which is needed to manage the City's water rights in an efficient and effective manner and which will enhance the City's ability to get through at least a 1-in-50 year drought. New storage capacity in the range of 12,500 to 14,000 acre-feet shall be pursued to (1) help meet return flow obligations incurred from transfers of water rights from agricultural use to municipal use, (2) provide carryover water from wet years to dry years, and (3) provide operational flexibility, some redundancy and reliability. Storage options include the enlargement of Halligan Reservoir, the development of local gravel pits into storage ponds, the acquisition of storage capacity in new or existing reservoirs, or some combination of the above.

d. Use of Existing Supplies. The City will use its existing supplies to meet municipal obligations with the following priorities: (1) to meet water demands by the City's treated water customers, and (2) to meet raw water needs in the City and to meet other obligations of the City. Raw water needs include use for such purposes as irrigation of City parks, golf courses, cemeteries, and other greenbelt areas. Other raw water obligations include primarily water transfers to other entities because of agreements or exchanges made to manage the water supply system more effectively. Water not needed for the above purposes is referred to as surplus water and may be made available to others in accordance with decrees and other policies that may apply.

3. Water Supply Shortage Response Plan

The City will maintain a plan for responding to situations where there are projected water supply shortages, either because of severe drought conditions or because of disruptions in the raw water delivery system. This plan may include measures to temporarily reduce water use through media campaigns, various regulations, restrictions, rate adjustments and others. The plan may also include provisions to temporarily supplement the supply through interruptible water supply contracts, leases, exchanges and operational measures.

4. Use of Surplus Raw Water

To the extent the City has surplus raw water available after meeting the needs of its treated water customers and meeting other raw water obligations, it will make water available to entities or individuals at a fair rental market price that helps offset the City's cost of owning such supplies. Other objectives or uses of the surplus water include, in no particular order, providing irrigation water to farmers to provide for the continued production of agricultural crops in the Cache la Poudre River Basin and the Northern Colorado Water Conservancy District, helping maintain open space and natural areas supported by Fort Collins, and providing for other uses as opportunities arise.

5. Regional Cooperation

a. Working with Other Municipal Providers. The City will continue to work with the water suppliers throughout the Northern Colorado Front Range to assure that adequate supplies are maintained in the region. When benefits are identified, the City will cooperate with area entities in studying, building, and sharing capacity of water transmission lines, distribution systems, and storage reservoirs. Entities in this area that have many common interests with the City and which the City has the potential to cooperate with include the Soldier Canyon Filter Plant and the associated water districts, the City of Greeley and the Northern Colorado Water Conservancy District. In particular, the City should work closely with water districts that serve Fort Collins residents to encourage similar policies regarding drought protection and to provide mutual assistance during emergency situations.

b. Working with Local Irrigation Companies. The City will continue to cooperate with local irrigation companies regarding the transfer, exchange and use of water in the Cache la Poudre River Basin. As a major shareholder in many of the local irrigation companies, it is necessary and desirable that the City work closely with these companies.

c. Transferring Water Rights from Agricultural to Municipal Use. The City will periodically transfer its water rights from agricultural use to municipal use on those shares that come from areas upon which the City is growing, or from shares where the irrigation of such lands has ceased. For water rights that were derived from irrigated agricultural lands that remain in viable agricultural areas, the City may transfer these water rights to municipal use when a need is identified or other factors make it prudent to do so. To the extent that this water remains surplus to the City's need, the City will continue to support the local agricultural economy by renting this surplus agricultural water back to irrigators under the respective irrigation companies.

6. Raw Water Quality

The City will take a proactive role in protecting the quality of water in the various watersheds from which the City's raw water is derived. The acquisition, development, and management of the City's raw water will be consistent with the City's Drinking Water Quality Policy and other applicable policies related to watershed protection.

7. Stream Flow and Ecosystem Protection

To the extent the City's use of its water rights and water resources are not adversely affected, the City will cooperate with other local groups or agencies to encourage flows in local streams to protect the ecosystem, in accordance with Colorado water law and the administration of water rights in Colorado.

8. Recreational/Aesthetic Flows

To the extent the City's use of its water rights and water resources are not adversely affected, the City will cooperate with other local groups or agencies to explore projects or measures that would provide flows in streams and water in reservoirs for recreational and aesthetic purposes, in accordance with Colorado water law and the administration of water rights in Colorado.