Water Supplies and Demands for Participants in the Northern Integrated Supply Project

Prepared for

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SECTION ONE
Introduction

This introduction describes a research effort and report prepared by Harvey Economics (HE) for the Northern Colorado Water Conservancy District (Northern District), acting on behalf of the Northern Integrated Supply Project Water Activity Enterprise (NISP). The report's purpose, approach, organization and caveats are described below.

Research Objective, Purpose and Background

HE was originally commissioned by the Northern District in June 2004 to evaluate and prepare water demand forecasts for each of the NISP Participants (Participants), along with a discussion of conservation practices employed by these Participants. Separately, the Northern District staff prepared an evaluation of water supplies for each Participant. These two work elements were then combined to assess potential future water shortages relevant to a determination of purpose and need for NISP. This study was provided to the U.S. Army Corps of Engineers for its use in considering NISP purpose and need and in preparing Chapter One of the NISP Environmental Impact Statement (EIS).

The Northern District had sponsored two other previous water demand studies in the past 15 years. In the year 2000, the Northern District completed a land use based projection of water needs. Unlike the present HE study, that previous effort was focused on demands at buildout capacity. In 1991, the Northern District published the *Regional Water Supply Study*, which examined water requirements for a number of providers, including some of the current Participants. Economic and demographic conditions and prospects have changed considerably for Northern Colorado since that time.

In 2010, HE was again commissioned by the Northern District to update the original study. During the six years since the original study, numerous events have prompted the need for an updated of the 2004 effort. First, numerous comments were received on the draft EIS from the EPA and others, suggesting that with such a severe economic downturn, housing development reversals and declining water use patterns, that water demand projections be reconsidered. Indeed, growth patterns and housing development experienced a major dislocation beginning in 2008 that has not yet concluded as of this writing in late 2010. Water use patterns also declined since the original assumptions were developed in the 2004 report because of drought response conservation measures, the economic downturn and more than normal summer rainfall.

Research Approach

The HE study team (study team) consisted of Ed Harvey, Susan Walker, Ben Norman, Melinda Ogle and Ginny Brookhouser, who together conducted the research and analyses related to water demands and conservation. The study team also included Carl Brouwer and Katie Melander, from the Northern District, who provided water supply data and other historical information collected from the Participants. The research approach entailed

extensive data collection, evaluation and analysis of the information provided, plus conclusions about future water demands and need for NISP. The study team gathered and reviewed supply and demand related information collected by the Northern District and others. The study team established data collection goals for each Participant and then compared those goals with the information collected in the 2004 effort. Personal interviews were conducted with each of the Participants to gather any remaining necessary information, and several follow-up contacts with most Participants were necessary to gather all final information available from each Participant.

The data collection effort, growth projections and water demand projections for each Participant were accomplished as an iterative effort. Initially, the study team provided each of the Participants with a list of information and subject categories that would become part of the purpose and need study. Each of the Participants provided published reports prepared by themselves or by consultants, along with internal operating data related to past and future growth, water use, conservation and water supply. The study team reviewed this information and developed interview questions for each of the Participants to complete the data collection effort. During the personal interviews, Participants were informed of the scope of the purpose and need inquiry, additional information was collected, and data sources were reconciled. In addition to information collected from Participants, the study team gathered published studies and other data from local, state and Federal government sources related to growth, water use and conservation relevant to Northern Colorado.

With the data collection phase completed, the study team evaluated projections of growth, water demand and supply as provided by the Participants for acceptance, rejection or modification. The bulk of Participant growth projections were based on recent growth trends and percentage growth rate assumptions, informed by developer projections. The study team evaluation was based upon historical evidence, capacity for growth, developer plans, land use plans, local government policies and an overall understanding of growth in the region. Judgment and reasonableness based upon past experience were applied in determining whether to accept or reject Participant projections. In the 2004 study, HE typically adjusted downward what it considered to be exuberant projections based on unsustainable growth trends. For the 2010 update, the Participants adjusted downward their own growth projections, in some instances excessively. In consultation with those few participants, growth projections were adjusted upward to represent a more reasonable long-term outlook.

Besides growth projections, the study team scrutinized historical water use patterns, beginning with sales to end users, separately examining individual agricultural or industrial, water intensive customers. The water demand projections were mostly based on water use per capita or per tap assumptions. Assumed future water use patterns reflected recently reduced usage and current conservation effects. Potable and non-potable demands were considered separately. Water use projections included losses within the distribution system, at the treatment plant or through conveyance or storage. On the basis of all these evaluations, the study team either accepted the Participant's growth and water demand forecasts or independently developed demographic and water demand projections for that Participant.

The study team then prepared draft updates to the original working papers describing historical information, current status, water demand projections and conservation initiatives,

shown as appendices to this report. These were reviewed by each of the Participants for accuracy. Participants had the opportunity to disagree with assumptions, and further discussions with the study team ensued, leading to a mutual agreement among each of the Participants and the study team that the information and projections in the appendices in this report were as accurate as possible, given available data and the inherent uncertainty of forecasts, generally. Final versions of the Participant water demand evaluations are set forth in Appendices A through O. Specific water sources and firm yield estimates for each Participant are compiled in Appendix P.

Table I-1 lists Participants that were included in this study and the NISP firm yield request of each.

Table I-1.
New Permitted Firm Yield from NISP Sought by Participants

Participant	Permitted Yield Requested (AF)
Central Weld County Water District (CWCWD),	3,500
City of Dacono	1,000
Town of Eaton	1,300
Town of Erie	6,500
City of Evans	1,600
Town of Firestone	1,300
Fort Collins -- Loveland Water District (FCLWD)	3,000
City of Fort Lupton	3,000
City of Fort Morgan	3,600
Town of Frederick	2,600
City of Lafayette	1,800
Left Hand Water District (LHWD)	4,900
Morgan County Quality Water District (MCQWD)	1,300
Town of Severance	1,300
Town of Windsor	3,300
Total	**40,000**

Source: Northern Colorado Water Conservancy District, 2006 Phase III Participation and Budget.

Report Organization

Following this introduction, this report proceeds with an overview of Participants' water demands. This overview describes historical demographic and water use changes and projections of future demographic conditions and water demands. Section Three provides an identification and evaluation of conservation practices and water use patterns expressed as gallons per capita per day. Participants' water conservation programs are identified in individual Participant water demand evaluations in Appendices A through O.

Section Four focuses on net future water needs by comparing firm annual yields in 2010 with projected water demands. Finally, the report concludes with an identification of each Participant's need for NISP.

Caveats

Standard data sets across all Participants were unavailable. The recordkeeping and data retrieval system for each of the Participants is unique to that Participant. Because of the location and nature of each customer base, water providers, even in close proximity to one another, record, report and utilize different measures as they conduct water resource planning. For example, rural water districts do not normally report population estimates on a consistent basis; rather, they keep track of their customer base by the number of taps, sometimes by type of tap or type of customer. Depending on the rate schedule, Participants may or may not keep track of water use by type of customer. Hence, historical recordkeeping practices are not the same from Participant to Participant, although individual practices may well serve each Participant's water planning purposes. To address this issue, the study team worked with the water use and supply records available for each water provider. From those data, the study team developed historical trends and water use patterns that maximized the completeness of foundational information for each Participant.

Just as the historical demand data were not standardized among Participants, existing projections of water demand also were not standardized. Methodologies for projecting future water demand differ substantially from Participant to Participant, and these methodologies are often determined by the historical foundation of information, by different consultants employed by each Participant, the size and technical capabilities available to a Participant, and the nature of the Participant's service area. Further, Participants adopt projections of demographic change from different sources and focus on different measures, such as population, housing units, number of taps or land uses. The study team adopted the view that no single forecasting methodology was necessarily more acceptable than others, and, similarly, data sources and information driving those projections might come from different sources but still be the most reliable data sources as they pertain to that Participant. For instance, one Participant might rely on its own population or housing unit projections that are up-to-date with specific developer information, as compared with the Colorado state demographer's projections that naturally lack this kind of local data. Under conditions of rapid change, local information is preferred.

An important caveat for this study and for all studies of this kind lies with the inherent uncertainty of forecasting in general, and of demographic forecasting in particular. Long-term projections always rely upon underlying assumptions, some of which are assumed to continue on into the future, and some of which are assumed to change. For example, this report assumes that migration will continue, as it has in the past, to be the predominant influence on population and housing unit growth in Northern Colorado, whereas natural population changes driven by birth rates and mortality rates will not be a major influence on these projections. Technology related to water use patterns is not assumed to change fundamentally over the long-term. Over the short-term, assumptions such as these are relatively safe, but over the long-term the error risk associated with such assumptions increases.

Other explicit forecasting assumptions such as growth rates, land-use policies and even service area boundaries for individual Participants will vary over the long-term as compared with the more static assumptions embodied in the study team projections provided in this report. For these reasons, long-term projections such as the demographic and related water demand projections provided in this report can be counted upon to be inaccurate on either the low side or the high side as the year 2050 approaches.

One important source of uncertainty in these water demand forecasts is the future growth rates. Rapidly escalating growth rates which have occurred among the Participants since 1990, dramatically reversed in 2008. Although there are strong indications that moderate growth will continue into the foreseeable future, the volatile nature of growth itself significantly adds to the uncertainty of these forecasts.

Further, estimates of firm annual yield for Participant water supplies represent only those supplies that existed in 2010. Water supplies can be reduced by water quality concerns, species or habitat preservation issues, or water right conflicts with competing users. Over the long-term, uncertainty of supply, mostly its diminution, as well as demand creates an uncertainty in the evaluation of the need for NISP presented in this report. If NISP Participants can trade NISP supplies among themselves, this uncertainty is reduced.

This report recognizes these many dimensions of uncertainty. Key assumptions are carefully scrutinized, and assumptions based upon the best available information are adopted where possible. The study team assiduously attempted to bring no bias into the assumptions underlying the projections offered in this report, but the study team recognizes that there is an equal chance that the assumptions could be wrong in either direction. Since no probabilities could be assigned to a different set of assumptions, the study team relied upon only a single set of projections with the presumption of uncertainty described here.

In summary, the study team evaluated demographic and water demand projections provided by each Participant on the basis of that Participant's individual circumstances. Comparisons with independently derived county or other projections were performed when relevant. The study team drew a conclusion about the water demand forecasting methodology and data sources for each Participant. If clearly better data or a superior demand forecasting methodology was available, the study team identified and then carried out those independent water demand projections. For example, if new lands were annexed to a water provider and not included in the water demand projections, the study team made the necessary adjustments. If assumptions behind the demand projections could not be substantiated with historical information, the study team developed new forecasting assumptions so that the results would be more reliable. The study team attempted to use the most appropriate information available for each provider and to present, in this report, the most defensible water demand projections for the NISP EIS.

SECTION TWO
Overview of NISP Participant Demands

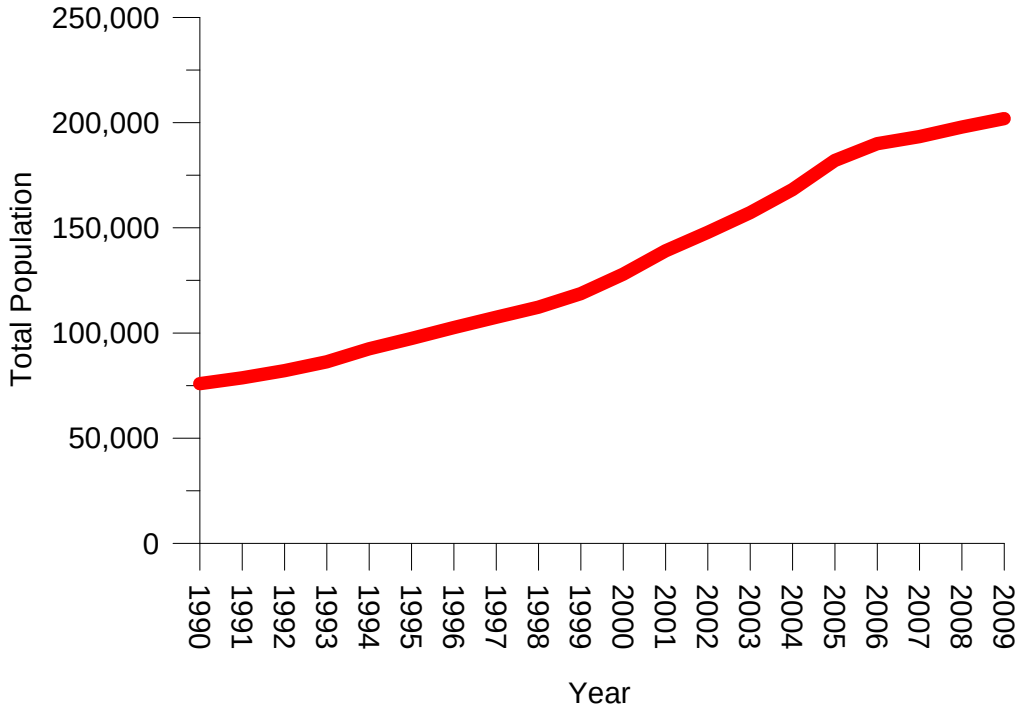
This report section provides the historical foundation for the demographic and water use changes experienced by Participants. Water demand projections combined for all Participants are also identified. Individual historical information and projections for each Participant can be found in Appendices A through O.

Historical Demographic Change

The study team attempted to gather historical population figures, numbers of water taps and housing units for the Participants. Whereas each Participant was able to provide the study team with one or more of these data sets, only population data were available from all 15 Participants.

Figure II-1 depicts historical population trends for all the Participants combined from 1990 through 2009.

Figure II-1.
Population Growth for NISP Participants in Total, 1990 through 2009



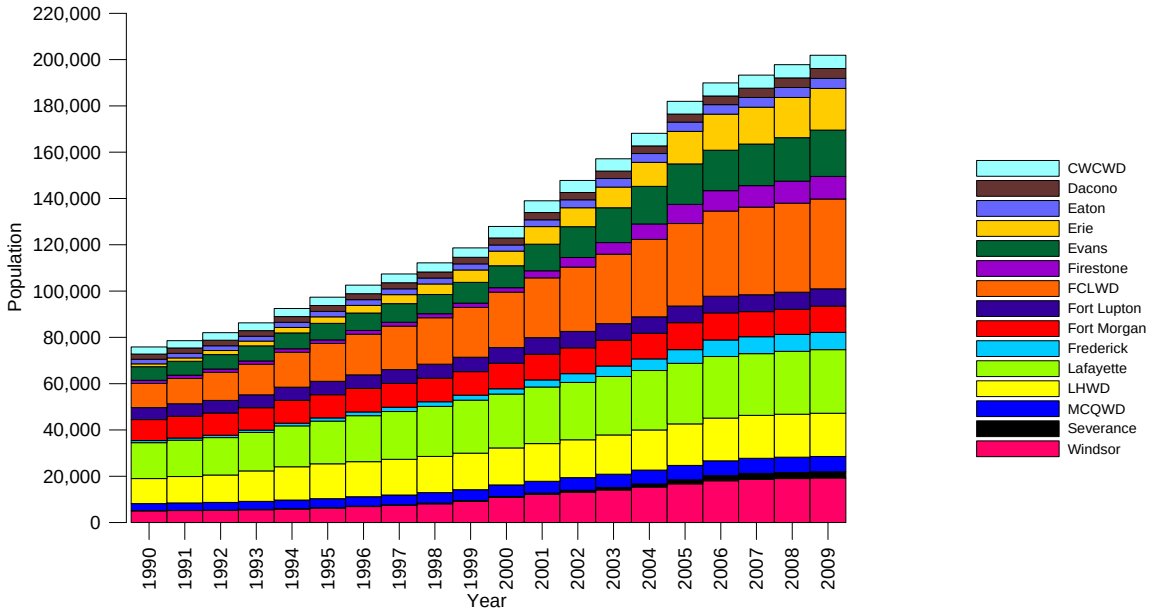
Note: The study team sought the total number of residents in the service area of each Participant from 1990 to 2009. Estimates for missing years were made on the basis of housing units or water taps for a small number of Participants.

Together, the 15 Participants served water to 76,000 persons in 1990, increasing to 202,000 persons by 2009. This expansion represents an average annual growth rate of 5.3 percent.

This unusually rapid growth indicates the considerable in-migration that occurred in northern Colorado between 1990 and 2009, likely attributable to a substantial increase in job opportunities in the northern Front Range during this time. From 2004 to 2009, the average annual growth rate for Participants was 3.7 percent, reflecting the recent economic slowdown.

Figure II-2 illustrates population growth by each Participant from 1990 through 2009.

Figure II-2.
Population Growth for Each NISP Participant, 1990 through 2009



Population growth is widespread among all the Participants. The Town of Erie and the Town of Severance grew faster than the other Participants; Severance grew from a population of 89 in 1990 to 2,600 people by the year 2009. The Town of Erie grew almost 1500 percent from 1990 through 2009. The most heavily populated water suppliers in 2009 were the Fort Collins-Loveland Water District with 38,800 residents followed by the City of Lafayette with about 27,500 residents. Together, these two water providers accounted for about one third of the total population of all the Participants in 2009.

Historical Water Use

The 15 Participants serve residential, commercial, industrial, public and other water uses in their service areas. These service areas include communities and the surrounding vicinity in some instances and primarily rural areas with small population centers in others. The study team gathered data for total water use by customer type delivered at the tap, where possible. In many instances, a full breakdown of water use by type of user was not available; however, the study team did distinguish each water provider's large industrial or other single large water users. Historical water uses by customer type, where available, are described for each Participant in Appendices A through O.

Potable water deliveries to end users are segregated from non-potable water deliveries since seven out of the 15 water providers deliver non-potable supplies for irrigation of golf courses, parks, schools and large residential or commercial developments. Whereas these seven water providers are responsible for the non-potable supplies, the Town of Windsor has a dual water system for some land development for which it has no supply obligation.

Table II-1 shows potable and non-potable water deliveries by Participant for 2009.

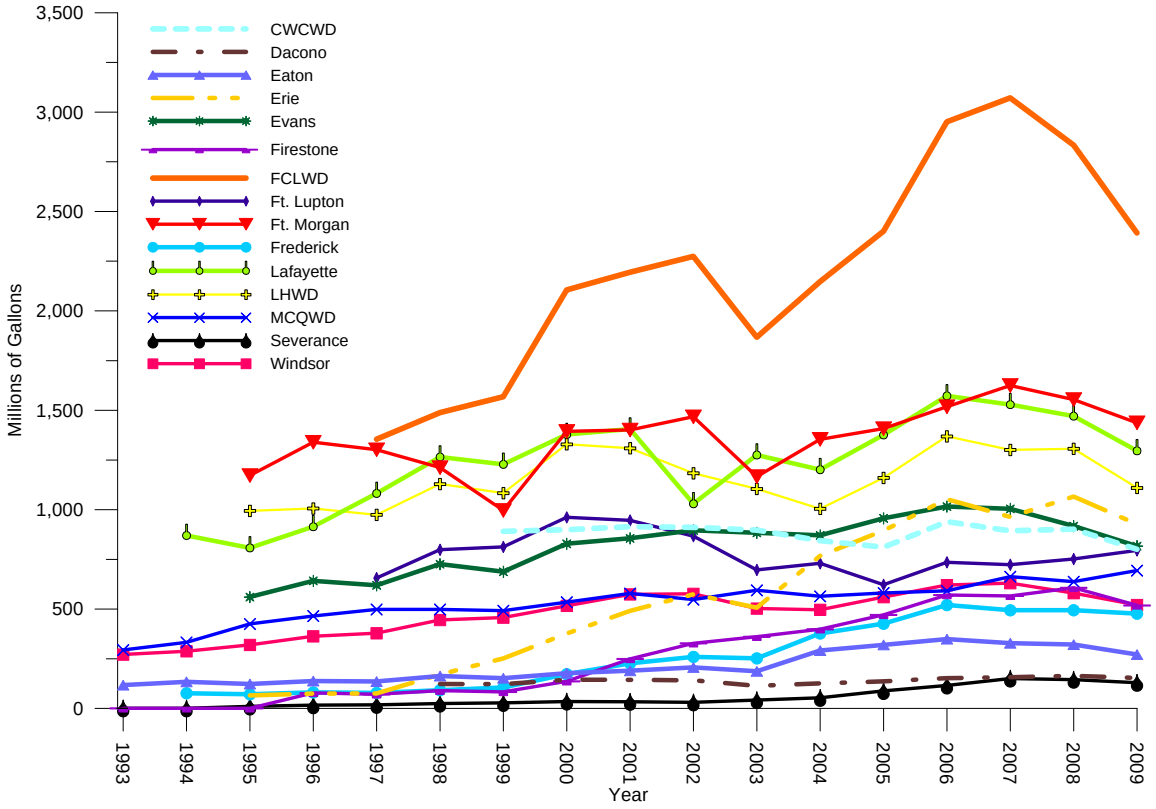
Table II-1.
Potable and Non-Potable Water Deliveries by NISP Participants, Millions of Gallons, 2009

Participant	Potable Deliveries	Non-Potable Deliveries	Total Deliveries
CWCWD	800	0	800
City of Dacono	152	0	152
Town of Eaton	183	88	271
Town of Erie	865	62	927
City of Evans	735	82	817
Town of Firestone	518	0	518
FCLWD	2,392	0	2,392
City of Fort Lupton	400	395	795
City of Fort Morgan	1,278	159	1,437
Town of Frederick	477	0	477
City of Lafayette	1,189	107	1,296
LHWD	1,109	0	1,109
MCQWD	693	0	693
Town of Severance	111	18	129
Town of Windsor	524	0	524
Total	**11,427**	**910**	**12,336**

Together, potable and non-potable water deliveries amount to total water deliveries to NISP end users; these total deliveries were a combined 12,300 million gallons (MG) in the year 2009. This amount was down from a peak of 14,100 MG in 2006 and 2007

Figure II-3 indicates total water deliveries to end users for each Participant between 1993 and 2009.

Figure II-3.
Total Water Deliveries to NISP Participants' End Users, 1993 through 2009, Millions of Gallons



Certain water suppliers do not have a complete data set for this time period, as indicated in the chart. Nevertheless, the trends, by and large, show increases in end user deliveries that accelerated through the year 2000 before flattening and then declining, as a result of drought and related restrictions in 2003. Water customers among the Participants were very responsive to drought related restrictions in recent years. For most Participants, water use rose modestly when drought restrictions ended, peaking in 2007 and falling off to lower levels in 2008 and 2009, due to a number of factors, including timely precipitation, the economic downturn and conservation.

Demographic Projections

The 15 Participants utilize a host of different demographic projections to develop their water demand projections. Nine Participants prepared population projections, whereas 5 Participants utilize water tap projections and one Participant prepared housing unit projections. The study team evaluated these projections and their application techniques and modified, updated or replaced them where necessary. Details of demographic and other variable projections are provided for each Participant in Appendices A through O.

Water Demand Projections

Many Participants provided the study team with their own existing water demand projections. The study team either utilized the Participant's water demand forecasts or independently projected potable water deliveries and non-potable water deliveries and summed both to arrive at total water delivery estimates for each Participant. Most existing water delivery projections were derived from demographic projections applied to a water use factor such as gallons per capita per day (gpcd) or gallons per tap per day (gptd). The study team scrutinized each potable water demand forecasting technique and either accepted it, if appropriate, or applied a different technique relevant to that water supplier and used existing projections as a check on those new water demand projections.

Total water deliveries, the sum of potable and non-potable deliveries, are projected to increase by almost threefold from the peak year of 2007, when total deliveries reached 14,100 MG. By 2060, total water deliveries for all Participants are projected to reach 40,400 MG. Increases are expected from all Participants. Potable water deliveries for all Participants are projected to increase from 11,500 MG in 2009 to 35, 800 MG in 2060. Non-potable deliveries were projected for eight Participants who intend to rely on non-potable resources in the future. Non-potable deliveries are expected to increase from a peak of 1,250 MG in 2004 to 4,600 MG in 2060. Table II-2 provides the potable, non-potable and total delivery projections for the Participants through 2060.

Table II-2.
Projected 2030 and 2060 NISP Participant Deliveries of Potable and Non-Potable Water, Millions of Gallons

	2030 Deliveries			2060 Deliveries		
Participant	**Potable**	**Non-Potable**	**Total**	**Potable**	**Non-Potable**	**Total**
CWCWD	1,600	0	1,600	2,300	0	2,300
Dacono	360	0	360	1,000	0	1,000
Eaton	270	170	440	620	260	880
Erie	2,400	2,300	4,700	4,400	2,300	6,700
Evans	2,110	250	2,360	2,270	270	2,540
Firestone	1,300	0	1,300	2,400	0	2,400
FCLWD	4,700	0	4,700	5,700	0	5,700
Fort Lupton	570	520	1,090	970	580	1,550
Fort Morgan	1,900	220	2,120	2,600	220	2,820
Frederick	1,000	180	1,180	2,900	650	3,550
Lafayette	2,400	220	2,620	2,400	220	2,620
LHWD	2,800	0	2,800	3,300	0	3,300
MCQWD	940	0	940	1,500	0	1,500
Severance	910	140	1,050	910	140	1,050
Windsor	960	0	960	2,500	0	2,500
Total	**24,220**	**4,000**	**28,220**	**35,770**	**4,640**	**40,410**

Total water requirements are equal to total water deliveries plus an accounting for losses. Whereas total deliveries are expressed in millions of gallons consistent with Participants' end use sales records, total requirements are expressed in acre-feet, reflective of raw water resource planning units.

Losses are calculated for each Participant from the end user, or point of delivery, to the treatment plant or master meter, and then back to the point of diversion. The study team obtained these distribution, treatment plant and conveyance loss figures during interviews with each Participant, based upon their own estimates or calculations. Assumptions about future losses are based on existing estimated losses and indications from Participants about future losses. Total water requirements projections assume the following combined distribution, treatment plant and conveyance losses set forth in Table II-3.

Table II-3.
Estimated Future Water Losses for NISP Participants

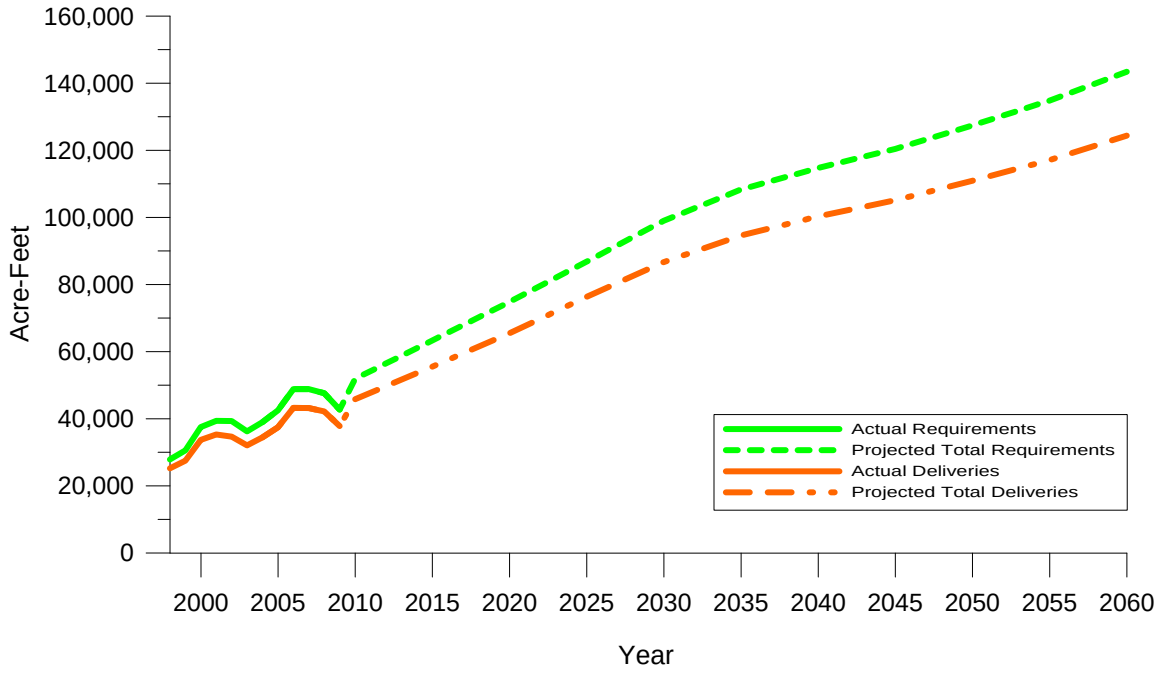
Participant	Losses as a Percent of Total Water Requirements
CWCWD	7%
Dacono	5%
Eaton	8% (1)
Erie	13%
Evans	8% (2)
Firestone	0% (3)
FCLWD	3%
Fort Lupton	10%
Fort Morgan	17%
Frederick	1% (4)
Lafayette	8%
LHWD	14%
MCQWD	3%
Severance	5% (5)
Windsor	9% (6)
Average	**7%**

(1) Does not include 10 percent water resource charge by NWCWD compounded with 8 percent local distribution losses.
(2) Does not include 13.5 percent shrinkage charge from Greeley.
(3) Does not include CWCWD treatment surcharge of 10 percent.
(4) Does not include CWCWD treatment surcharge of 20 percent.
(5) Does not include 10 percent water resource charge by NWCWD.
(6) Does not include 17 percent charge, which is the weighted average water resource charge from Windsor's three treated water suppliers.

A number of Participants acquire their water in a treated form from other water providers who charge 10 to 20 percent water surcharges as a water resource fee.

Figure II-4 provides historical and projected total water requirements and total water deliveries for all Participants from 1998 through 2060. Complete data sets were not available for all Participants prior to 1998.

Figure II-4.
Historical and Projected Water Deliveries and Total Water Requirements for NISP Participants, 1998 through 2060, Acre-Feet

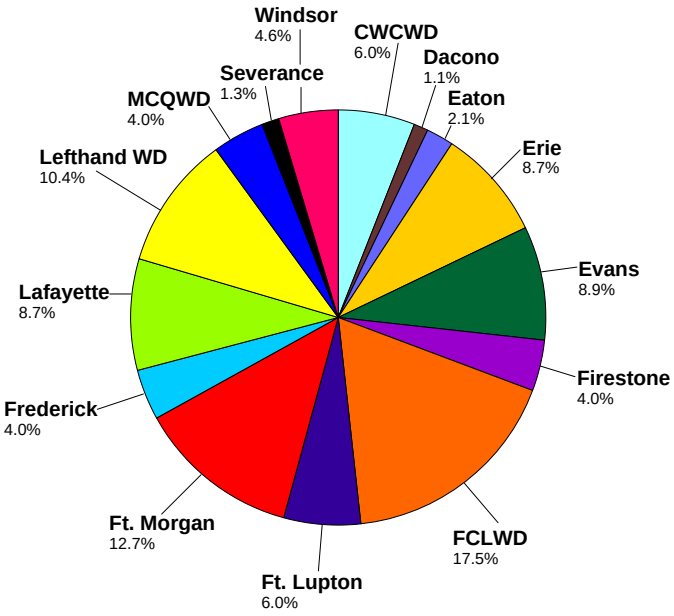


Total water requirements, which include all forms of losses and wholesale water resource fees, are projected to increase from 48,800 acre-feet (AF) in 2007, the peak historical year, to 143,400 AF by the year 2060. This nearly threefold increase would indicate that the Participants together will experience an increase in total water requirements of almost 95,000 AF by 2060.

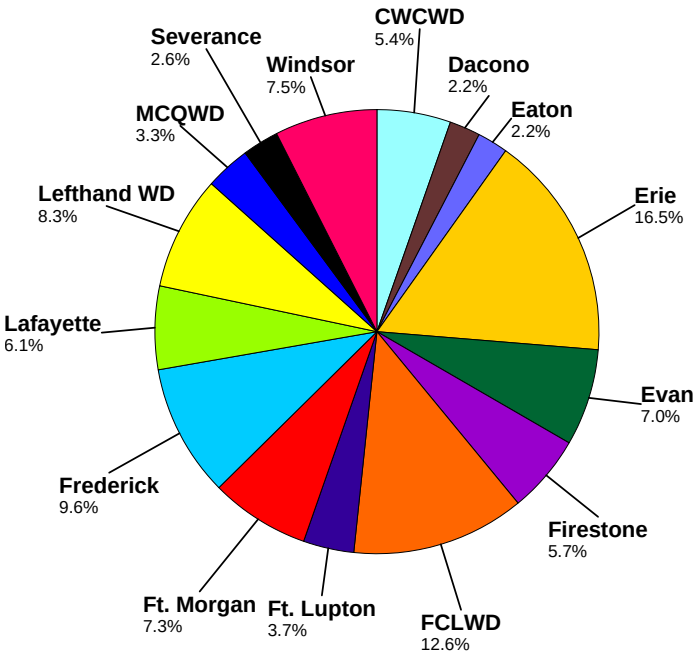
Figure II-5 presents two pie charts, one of total water requirements by Participant in the year 2010, and the other of total water requirements by Participant in 2060.

Figure II-5.
Total Water Requirements among NISP Participants, 2010 and 2060

Year 2010



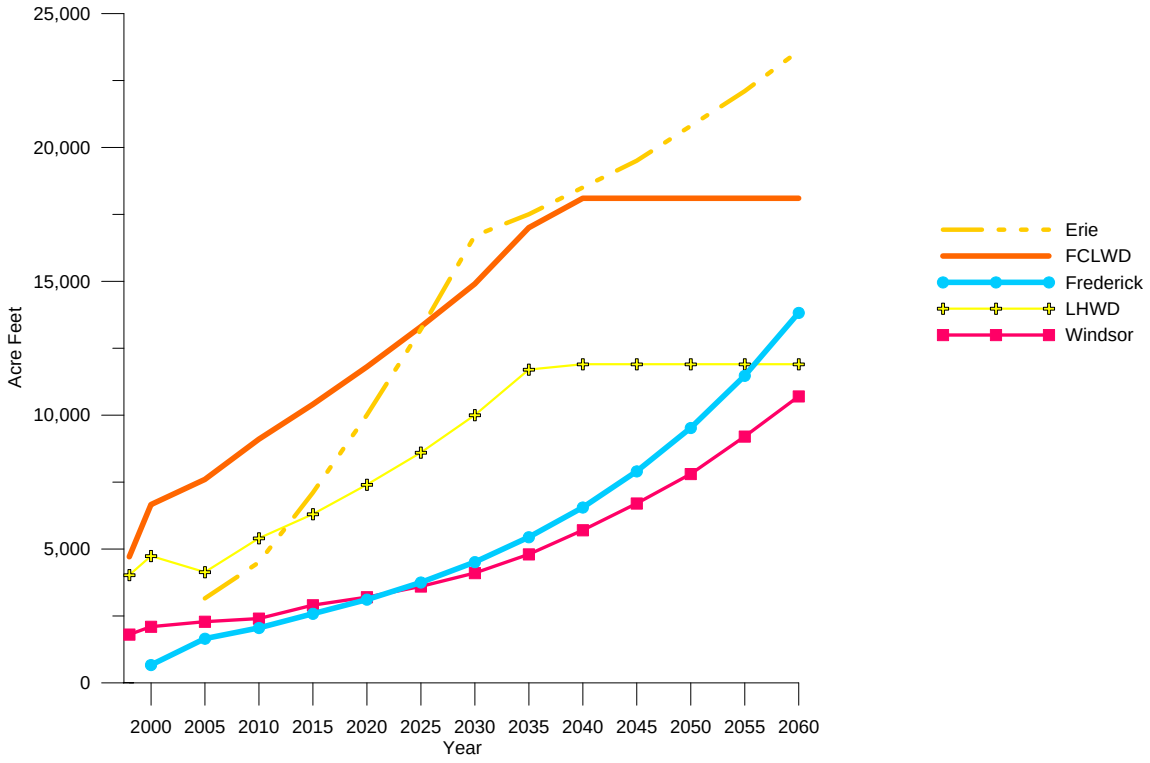
Year 2060

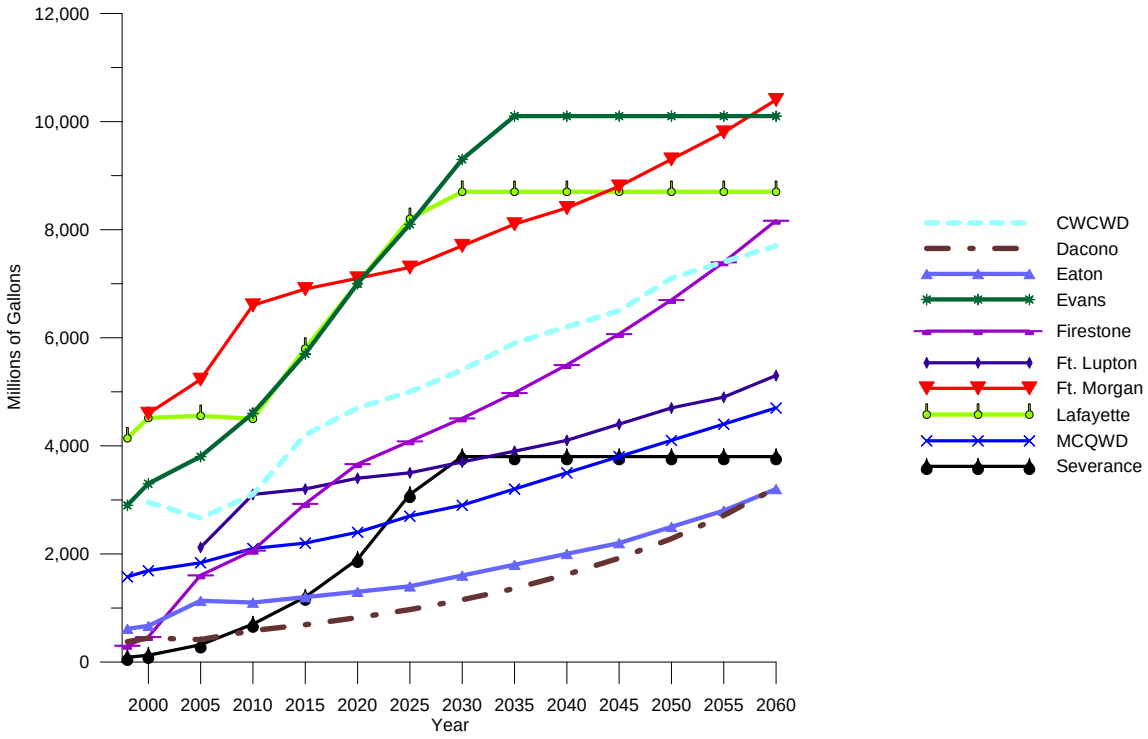


FCLWD, LHWD, Ft. Morgan, Evans and Lafayette, are projected to have the largest water demands in 2010. Erie, FCLWD, Frederick, LHWD, and Windsor will be the largest water providers in 2060.

Figure II-6 graphs projected total water requirements by Participant through the year 2060. To assist the reader, the first graph includes Erie, FCLWD, Frederick, LHWD and Windsor. The remaining water users are shown in the second graph.

Figure II-6.
Total Water Requirements by NISP Participant, 1998 to 2060, Acre-Feet





This figure illustrates that a number of water providers will reach buildout during the forecasting horizon, beginning in 2035. The most rapidly increasing water demands will occur in Severance, Erie, Dacono, Windsor and Firestone.

In sum, these water demand projections point to very substantial increases within the next 50 years for the Participants. The study team water demand projections imply an average annual growth rate of 2.4 percent from 2009 through 2060, which compares with an average annual growth rate of 3.4 percent from 1999 through 2010, measured on the same basis.[1] These projections do indicate that future total water requirements will continue to increase but at a decreasing rate over time. The study team believes that these water demand projections represent the most reliable, justifiable projections available for these Participants.

[1] Data for CWCWD were not available for 1998.

SECTION THREE
Summary of NISP Participant Conservation Efforts

This section provides an evaluation of ongoing water conservation efforts among the Participants and their customers. The extent of current conservation helps determine the potential for additional water conservation savings that might be available to Participants in considering their need to participate in NISP.

It is important to distinguish ongoing water conservation programs from drought related measures. Water conservation measures are those programs that are consistently applied every year to reduce water demands or to increase supplies. These measures are distinguished from drought restrictions that are special, more severe measures that are implemented temporarily to avoid a true water shortage. Drought restrictions are normally reserved by water resource managers for unusually adverse hydrologic conditions or for unexpected circumstances that threaten the ability of the water provider to meet its customers' requirements.

This section provides a brief summary description of the conservation programs currently in place among the NISP Participants, followed by an evaluation of water use patterns. These water use patterns, measured in potable gallons per capita per day, provide an indication of the effectiveness of the conservation efforts currently being practiced among the customers of the Participants.

Conservation Program Overview

The study team gathered information about the different conservation programs practiced by each Participant during personal interviews and in reviews of past studies for each Participant. The water conservation programs for each Participant are described in detail in Appendices A through O.

It is important to recognize that each Participant applies a unique mix of conservation measures suitable to the particular conditions in its community and to the operation of their water system. A brief overview of Participant conservation measures is provided below.

- *Central Weld County Water District (CWCWD)* – CWCWD implemented its water conservation plan in 2003, emphasizing among other elements a diverse public education effort. CWCWD encourages its dairies and other agricultural businesses to use non-treated water when possible. CWCWD utilizes an especially aggressive and advanced computer leak detection system, which monitors inflows and outflows every 2.5 minutes, facilitating rapid system repair. Its conservation plans call for a future review of its rate structure, including an incentive/reward mechanism and potential surcharges for excessive use.

- *City of Dacono* – Dacono encourages water conservation through a variety of measures. They use an increasing block structure for billing, provide their customers with information / education on conserving water, and enact watering restrictions every summer. In addition, they use a demand based formula for calculating the amount of water to be dedicated to each new development. Any conservation measures that are incorporated will reduce the dedication for the developer, providing an incentive to conserve. In 2010, Dacono received funding from CWCB to prepare its conservation plan.

- *Town of Eaton* – Eaton also has an increasing block rate structure and a public information program, including website information for its customers. Eaton requires new developments to construct a dual use irrigation system which will cut down substantially on summer water use, as reflected in the demand projections in this report. In March of 2010, Eaton applied for a grant to develop a Water Conservation Plan.

- *Town of Erie* – Erie updated its Water Conservation Master Plan in 2008; the goals include a 15 percent reduction in water use for all city property and an average annual gpcd of 190. They have a diverse public education program that includes a six-part series on the local television station related to water conservation. Erie's conservation program emphasizes low water use landscaping for open space and parks, which Erie believes may eventually save as much as 1,100 acre-feet per year. Other components of the Erie conservation plan include leak detection on a continuous basis, an irrigation audit program and an increasing block rate structure. Reusable effluent is used for golf course and landscape irrigation.

- *City of Evans* – The City of Evans 2009 Water Conservation Plan set a goal of reducing water use by 13 percent by 2018. The plan emphasizes an increasing block rate structure, non-potable water use for residential irrigation, and an active leak detection program. In addition Evans has introduced a rebate program for water efficient devices.

- *Town of Firestone* – In their 2007 Water Conservation Plan, Firestone outlines four conservation goals: reduce residential gpcd and commercial water use by 5 percent; reduce park water use by 8 percent; and reduce open space water use by 10 percent. These goals will be realized through a series of utility maintenance programs, regulatory measures, educational programs, and rebates and incentives

- *Town of Frederick* – Frederick estimates that its current conservation measures provide a 10 percent water savings. They have been notified that their application for funding a water conservation plan has been approved. The current measures include rewarding developers for conservation planning, an increasing block structure, and watering restrictions.

- *Fort Collins – Loveland Water District (FCLWD)* – FCLWD's water conservation goal is 13 percent per year. To meet this goal, they have an

increasing block rate structure and a surcharge, which it applies to users who exceed the established monthly allocation. The district's public information program includes a website with conservation measures and offers to support customers in their various conservation efforts. FCLWD also has a leak detection program.

- *City of Fort Lupton* – As part of its 2007 Water Conservation Plan, the City of Fort Lupton set some long-term conservation goals: reduce residential water by 5 percent over the next decade and by 7 percent after that; meter the water sold to Thermo; and reduce city irrigation water use by 5 percent. To achieve this goal, Fort Lupton is committed to a diverse public education program, which includes monthly monitoring of water savings and a public display of the results. Fort Lupton applies specific water conservation measures to golf courses, restaurants and car washing, along with outdoor watering restrictions, all enforced by police and code enforcement employees. In June 2004, Fort Lupton instituted a large rate increase, including a surcharge for water use above a set supply allotment, by user.

- *City of Fort Morgan* – Fort Morgan has saved over 500 AF since implementing their 2006 Water Conservation Plan. Programs under this plan include: leak detection and repair; public education; and working with the largest industrial water users to help them conserve. In the 2008 Water Conservation Plan, Fort Morgan added new measures including: expansion of the landscape efficiency program and water recycling systems. *City of Lafayette* – The 2009/2010 Lafayette Water Conservation Plan has a goal to reduce annual water consumption by 507 AF and reduce system-wide losses to 5 percent. From the previous 1997 plan, Lafayette offered a diverse public education program and a tiered rate structure. New initiatives include irrigation system upgrades, water-efficient commercial processes, and improved water accounting and system-wide leak *detection.*

- *Lefthand Water District (LHWD)* – LHWD has an aggressive leak detection and repair program that has resulted in a 50 percent reduction of water distribution losses. The District emphasizes modification to low water use landscaping through demonstrations, classes and requirements for new development through Boulder County. LHWD has an increasing block rate structure. The District reviews high and low water consumption patterns among its customers and replaces meters regularly. The goal of the 2008 Water Conservation Plan is to reduce overall water use by 714 AF per year, by either expanding existing programs or implementing new ones.

- *Morgan County Quality Water District (MCQWD)* – MCQWD has an increasing block rate structure that it considers effective with its agriculturally oriented customers facing low financial margins. As of 2010, the District is in the process of developing a water conservation plan.

- *Town of Severance* – Severance has an increasing block rate structure and a public education program to promote conservation. The Town maintains permanent watering restrictions regarding days of the week and times of the day that customers can irrigate.

- *Town of Windsor* – Windsor has an increasing block rate structure and a surcharge for excessive water use. The Town has plumbing codes requiring low-flow water appliances, and new developments are required to develop dual water systems, where possible, using ditch water. New developments face landscaping restrictions, and all customers face lawn watering restrictions between 10 am and 6 pm during the summer. The Town also has a leak detection system, car washing guidelines and a diversified public information system promoting conservation. The overall goal of the 2008 Water Conservation Plan is a 12 percent reduction. This will be accomplished by either expanding existing programs or implementing new ones.

Ten out of fifteen Participants have active conservation programs in place. Almost all of the Participants have an educational component to their water conservation programs, which ranges from stuffing bills with water conservation reminders to websites, newspaper and television ads, and school programs. All of the Participants also practice universal metering to keep track of water use patterns and to charge customers for the water they consume. The water price signal to customers is accentuated by the increasing block rate structure that is in place for almost all of the Participants. The Participants exhibit considerable emphasis on a strong price signal to customers to conserve water. Leak detection and the repair or replacement of inefficient water mains, pipes and meters are also commonly used by many Participants.

In terms of outdoor water use, a number of Participants have landscape ordinances and permanent outdoor watering restrictions in place. Water audits and the promotion of water efficient appliances are also practiced by a number of Participants. Certain Participants have non-potable irrigation systems or a water re-use system in which wastewater is used for irrigation. In sum, the Participants' ongoing water conservation programs are typical among water providers, with, perhaps, a stronger emphasis on price signals to promote efficient use.

Historical Water Use Patterns

For this study, water use patterns refer to the magnitude of gallons per capita per day (gpcd) of potable water use among end users. In the 2004 NISP Report, the study team assessed the overall Participants' water use patterns and the water use patterns of each Participant individually based on a comparison of individual gpcd figures. Recent research by the American Water Works Association published in the *Water Conservation Measurement Metrics Guidance Report*[2] presents a number of findings that argue against measuring "relative water use efficiency across different utilities." The report emphasizes the difference between a metric, a unit of measure such as gpcd, and a benchmark which is a level of

[2] Dziegielewski, Ben and Jack C. Kiefer, *Water Conservation Measurement Metrics Guidance Report*. The American Water Works Association Water Conservation Division Subcommittee Report. January 2010.

performance of a given metric that is set as a goal. For accurate measurement of progress toward achieving efficiency goals, the report recommends disaggregation of water use into categories, such as indoor residential use. These goals should be particular to the utility and based on the characteristics of its users. For each disaggregated category of water use, the report recommends that a ratio-type benchmark be developed. The development of benchmarks is information intensive, which presents a considerable challenge. While the study team recognizes the validity of this recommendation, such data are not currently available from the Participants. The AWWA report also finds that comparisons of gpcd between water providers can be misleading. As a benchmark, gpcd is highly influenced by weather patterns and changes in customer characteristics. In addition, factors for determining gpcd often vary from utility to utility. That is, some utilities do not include losses in this calculation or may include transient populations, such as commuting workers. This finding is problematic as gpcd is the most commonly used measure by water utilities, both in Colorado and across the county. In addition, for the purposes of this study, it is the only metric available from all Participants. In fact, gpcd continues to be used for most planning efforts. While better methods might eventually be developed as recommended, at this time the study team finds no other means of determining the relative success of conservation efforts by the Participants than gpcd.

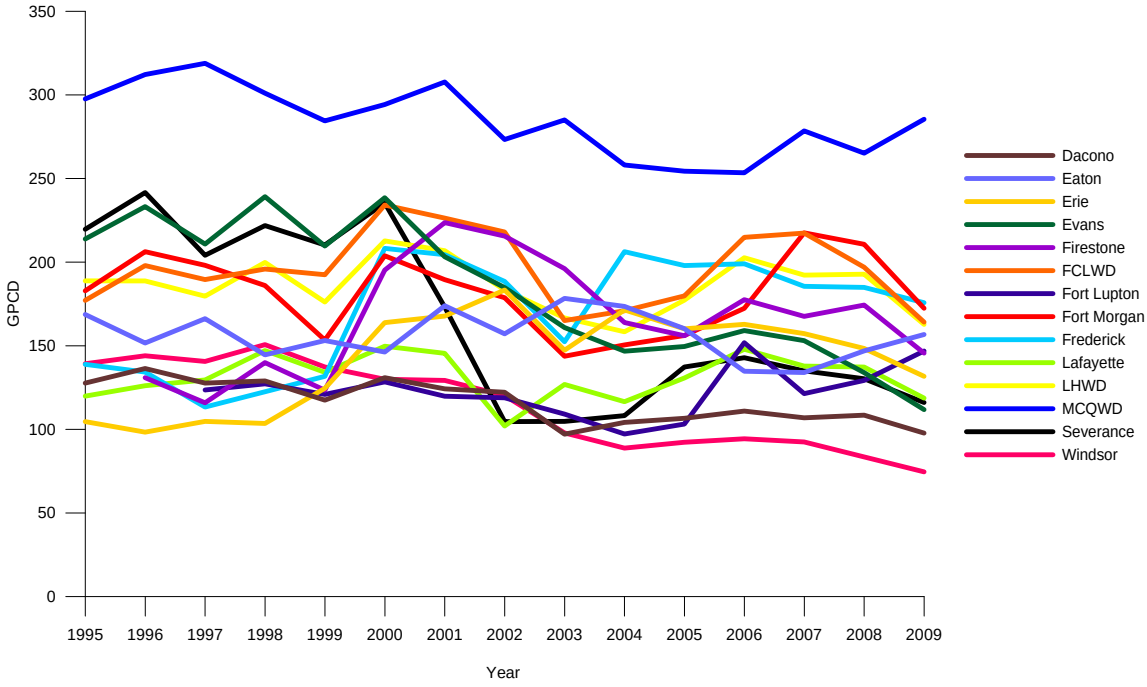
In order to alleviate some of the problems associated with gpcd metrics, the study team obtained the most consistent and accurate population and service area population data available. Gpcd data for the participants is provided below to demonstrate trends among the Participants as a group and for individual Participants.

Table III-1.
Gallons per Capita per Day of Combined NISP Participants

	Simple Average	Annual Change	Weighted Average	Annual Change
1999	190	NA	170	NA
2000	209	10%	192	13%
2001	205	-2%	182	-5%
2002	187	-8%	164	-10%
2003	172	-8%	147	-11%
2004	168	-2%	141	-4%
2005	170	1%	145	3%
2006	184	8%	160	10%
2007	180	-2%	157	-1%
2008	177	-2%	150	-4%
2009	162	-9%	132	-12%
Total Change		**-15%**		**-22%**

This table shows a simple average of gpcd for all 15 Participants from 1999 through 2009, and then an average gpcd weighted by the population of each Participant. Such a weighting reduces the influence of very small water providers, such as the Town of Severance or the Town of Eaton, in the calculations. Regardless of methodology used, the annual combined figures for the Participants indicate a gpcd that fluctuates up and down largely with weather and water use restrictions as well as economic conditions, but also demonstrates a trend of overall reduction in gpcd during the 1999 to 2009 timeframe. Figure III-1 illustrates the water use patterns for individual Participants from 1995 through 2009. CWCWD is not included in this figure but is discussed following Table III-2.

Figure III-1.
Water Use Patterns for NISP Participants, Gallons per Capita per Day, 1995 through 2009



From 1995 to 2009, most of the Participants experienced potable gpcd that fluctuated between a fairly narrow range, depending upon weather, and almost all experienced a substantial decline in 2003 due to drought restrictions. It is also evident from the figure that each Participant's water use patterns are unique from the others, even in the same region. The mix of customer types distinguishes the water use patterns of the Participants: the presence of large water users such as dairies or industry; new large lot homes versus older in-town lots; and the presence of commercial activity can all help determine the water use patterns of a single Participant and why they are different from another Participant.

Table III-2 provides annual total potable gpcd for each Participant from 1999 through 2009, along with averages during this period.

Table III-2.
Total Potable Gallons per Capita per Day Use for Each NISP Participant, 1999 through 2009

Participant	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average	Change 1999-2009
CWCWD	599	495	496	480	463	426	402	456	432	432	382	460	-36%
Dacono	117	131	124	122	97	104	107	111	107	108	98	111	-17%
Eaton	153	146	174	157	178	173	160	135	134	147	157	156	2%
Erie	125	164	168	183	147	171	160	163	157	148	132	156	6%
Evans	189	215	181	164	141	127	130	132	128	122	101	148	-47%
Firestone	123	195	224	216	196	164	156	178	168	174	146	176	18%
FCLWD	192	234	226	218	165	171	180	215	217	197	164	198	-15%
Fort Lupton	121	128	120	119	109	97	103	152	121	129	147	122	21%
Fort Morgan	153	204	189	179	144	150	156	172	217	211	172	177	12%
Frederick	132	208	204	188	152	206	198	199	185	185	176	185	33%
Lafayette	134	150	145	102	127	116	131	148	138	137	119	132	-12%
LHWD	176	213	207	183	167	158	177	203	192	193	163	185	-8%
MCQWD	284	294	308	273	285	258	254	253	278	265	285	276	0%
Severance	210	235	173	105	105	108	137	143	135	130	116	145	-45%
Windsor	137	130	129	120	98	89	92	94	92	83	75	104	-46%
Total NISP Average	**190**	**209**	**205**	**187**	**172**	**168**	**170**	**184**	**180**	**177**	**162**	**182**	**-15%**

The water providers with lower gpcd, including Windsor, Dacono, Evans and Severance are largely bedroom communities with a higher number of persons per tap than other water providers, which tends to lower potable gpcd. The water provider with the highest gpcd was CWCWD. CWCWD provides water to various agricultural and dairy users, such as Aurora Dairy. Since the CWCWD historical data could not distinguish dairies and other large agricultural water users within their commercial consumption data records, CWCWD was excluded from Figure III-1 above. Average residential use per capita per day for CWCWD, on the other hand, was 168 gpcd from 1999 through 2009. Morgan County Quality Water District also has substantial demand from dairies and agribusiness.

Evaluation of Water Use Patterns

The evaluation of Participant water use patterns is intended to answer this question: Are Participants' levels of water use and associated water conservation efforts reasonable, or should additional conservation efforts be assumed when considering need for NISP? The 2004 version of this study included a historical examination of water use patterns in Northern Colorado and also included a comparison NISP Participant gpcd to other western cities to answer this question. These data, while imperfect, provide the best source of information as to the ongoing conservation efforts of the Participants.

As shown in the water conservation overview above, most Participants have specific water conservation savings goals. These goals were established with each Participant's understanding of the characteristics of their customer base and have been taken into account in the demand projections for this study. Further, it is in the best interest of each utility to achieve their maximum conservation savings. For 13 of the participants, the firm annual yield from the NISP Project will fail to meet their projected needs over the study period. These providers will need to secure additional supplies or achieve additional savings through conservation. From an economic perspective, it is reasonable to assume that the Participants have sought or will seek maximum cost effective conservation savings before incurring the large costs associated with the NISP Project.

This evaluation begins with an historical look at water use patterns in Northern Colorado to identify what progress has been made in the area of water conservation. Next, this evaluation focuses on establishing a benchmark for reasonable conservation water usage for comparison with the Participants current water use patterns. A comparison to other western cities is also included to test the reasonableness of Participant water use.

Historical water use patterns in Northern Colorado. Two sources of information offer a comparison of historical water use with current water use patterns in Northern Colorado: the original Windy Gap EIS, which was prepared in the late 1970s and early 1980s, and the Northern District's *Regional Water Supply Study*, prepared in 1991.

The Windy Gap EIS focused on water use patterns of the original participants of that project: Boulder, Estes Park, Greeley, Longmont, Loveland and the Platte River Power Authority. Although none of these water providers are Participants in NISP, geographically they are representative of the Participants and experienced similar weather patterns. In Table 1-1 of that EIS, the average water use of the Windy Gap participants, excluding Platter River Power Authority, amounted to 250 gpcd, which compares with an average gpcd for the Participants in NISP from 1999 through 2009 of 182.

The Northern District's 1991 *Regional Water Supply Study* included estimates of water use patterns for water providers in Northern Colorado and projections of future water use for municipal and industrial water providers from the Northern Denver Metropolitan area through Boulder, Larimer and Weld Counties, including many of the Participants. The water use patterns of the Participants expressed in gpcd, according to the 1991 Regional Study, are presented in Table III-3:

Table III-3.
Water Use Patterns for Selected NISP Participants

Participant	1988	Average 1999-2009	Change 1988-2009
CWCWD	395	460	17%
Eaton	183	156	-15%
Erie	389	156	-60%
Evans	216	148	-31%
FCLWD	199	198	0%
Fort Lupton	326	122	-62%
Fort Morgan	280	177	-37%
LHWD	177	185	4%
MCQWD	245	276	13%
Windsor	140	104	-26%
Total NISP Average	**255**	**198**	**-22%**

Source: Northern Colorado Water Conservancy District and Municipal Subdistrict, *Regional Water Supply Study*, 1991

As a whole, the Participants for whom 1988 data are available show a greater than 20 percent reduction in gpcd. However, the variations from provider to provider are quite large. For example, MCQWD experienced a 13 percent increase in gpcd during this period. However, this increase is not due to a failure in conservation efforts, but rather to a growing number of dairies within the service area that as of 2009 represent more than 30 percent of total potable demand for the District. Conversely, Erie shows a remarkable reduction in gpcd of 60 percent. While conservation is likely responsible for a portion of this reduction, changes from an agricultural to suburban economy are also likely responsible for a good deal of this change.

A recent Bureau of Reclamation analysis of Douglas County water needs stated that a "typical minimum planning use is an average of 165 gallons per day per capita in an area without heavy industry."[3] The report goes on to say that Denver Water has a goal of 130 gpcd and makes projections for Douglas County utilizing both the 165 gpcd and 130 gpcd. In 2009, the average gpcd for participants, excluding CWCWD and MCQWD, which both have large dairies, was 136. On average, NISP Participants are in close range to this goal, suggesting adequate conservation efforts by the Participants.

Normally, water providers and their customers are motivated to take the first steps in a conservation program which achieve the largest savings at the least incremental cost. The

[3] U.S. Department of the Interior, Department of Reclamation. *Douglas County Rural Water Project Appraisal Report*. July 2010.

Participants have reduced use by implementing relatively inexpensive water saving measures such as public education, watering restrictions and low-flow fixture requirements and landscaping regulation for new construction. In the case of an individual family, this might mean turning off the water while brushing one's teeth, using a hose nozzle when washing the car and limiting outdoor watering. For that same family to achieve greater savings, it might be necessary for them to purchase more efficient appliances or re-landscape using native plants. These reductions would come at a significant cost to the family or to a utility offering rebates. Thus, once waste is reduced, other savings are likely to involve structural changes that are more costly.

Water use benchmark for NISP Participants. A water use benchmark applicable to the Participants may be useful in a comparison to those Participants' existing water use patterns to determine if additional water conservation is a reasonable expectation; however the establishment of such a benchmark is a challenge for a number of reasons.

(1) Numerous jurisdictions, including the States of Texas, California and Utah, have attempted to establish water conservation benchmarks, but each developed that benchmark in a unique manner suitable to its own purpose. No single, commonly accepted means for establishing such a benchmark is known to exist as of 2010.

(2) Many measures of water use exist, and the calculation of water use is performed differently by agencies and jurisdictions. For example, water use can be measured by gpcd, gallons per tap per day, gallons per household per day, residential water use per capita per day, and so on. Further, the point of measurement, i.e. public water supplies versus all water supplies, or population within the city limits versus service area population, is also not uniform.

(3) Customer characteristics vary from provider to provider and small providers are especially sensitive to changes in customer type.

In sum, establishing a benchmark has inherent limitations. For the purposes of this report, the defined benchmark requires judgment based upon comparable areas and an understanding of the site-specific circumstances of the Participants.

Regional average gpcds provide a starting point for establishing a NISP water use benchmark. The Statewide Water Initiative (SWSI) found that Colorado statewide gpcd averaged between 206 and 332, with the South Platte Basin as the lowest average in the state at 206 gpcd.[4] The EPA reports an average water use of 242 gpcd for the entire upper Colorado River Basin.[5] This same EPA report assigns a 194 gpcd to the Platte River Basin. A Western Resource Advocates report indicates an average gpcd for 13 large western U.S. cities of about 229 in 2001.[6] Yet another benchmark can be extracted from U.S. Geological Survey water use data produced in the year 2000. This Federal agency gathers water supply, demand and population data for counties throughout the U.S. every five years. In the year

[4] CDM, Statewide Water Supply Initiative, Executive Summary, Page ES-9.
[5] Environmental Protection Agency, accessed at EPA.gov/watrhome/use/cap1.html.
[6] Western Resource Advocate, Smart Water, Page 66, 2003.

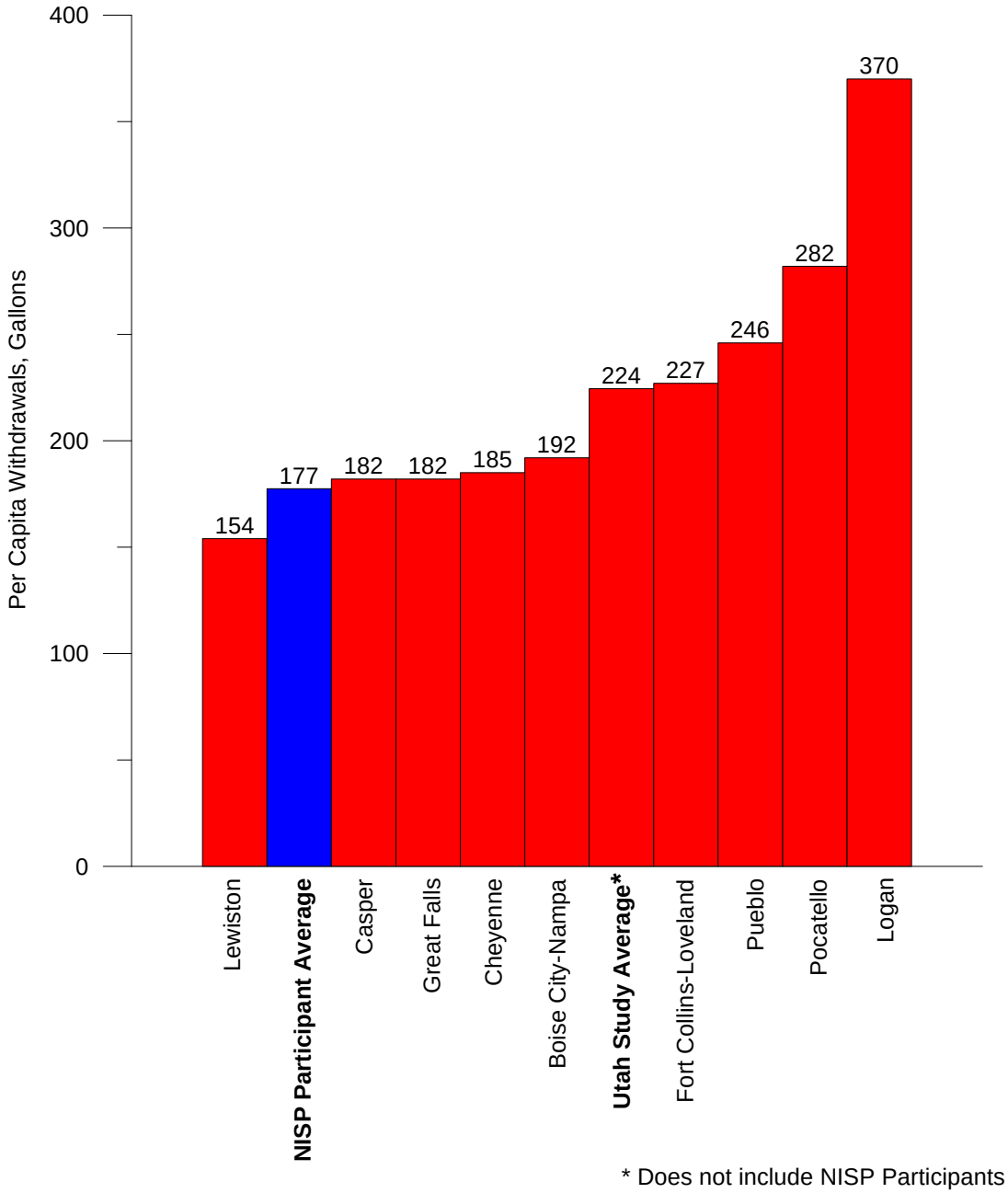
2000, admittedly a high water use year, the average gpcd for Colorado's portion of the South Platte Basin was about 200.[7]

An additional source of information for establishing a conservation water use benchmark comes from a study entitled, *Water Use and Residential Rate Structures in the Intermountain West*[8]. In that study, the authors provide water use information for 25 cities in the western U.S. of various sizes and locations. The average gpcd for these 25 cities was 243. However, this study also provides information about the size of each of the communities and their average precipitation and temperature. In isolating cities of less than 301,000 in population and cities with precipitation and average temperature within plus or minus 25 percent of the Fort Collins – Loveland area, a total of nine cities are identified including the Fort Collins – Loveland area. The average gpcd for these communities was 224, as shown in Figure III-2 below.

[7] US Geological Survey, Water Supply and Use, year 2000, Colorado.

[8] *Water Use and Residential Rate Structures in the Intermountain West*, Utah Economic and Business Review. Volume 65, March/April 2005.

Figure III-2.
Average GPCD for Selected Cities



As a final data point in considering the NISP benchmark, Denver Water exhibited an average potable gpcd usage of 180 between 1999 and 2009.[9] Denver is considered to have a well developed water conservation program and is considered by many to be an example of strong conservation along Colorado's Front Range. Denver Water' comparability is somewhat limited in this instance, since it is a much larger metropolitan area with different financial

[9] Comprehensive Annual Financial Report, Denver Water, December 31, 2008 and Comprehensive Annual Financial Report, Denver Water, December 31, 2009.

resources than the Participants. Denver Water data also include parks and other outdoor irrigation requirements, whereas potable water use per day within the Participants includes only potable supplies, excluding a modest portion of non-potable use for irrigation. Based upon the foregoing data points, and using its professional judgment, the study team established the water use benchmark of 215 gpcd for Participants' potable water use.

Comparison of Benchmark to NISP Participant Usage. The study team compared the benchmark of 215 gpcd to the average gpcd from 1999 to 2009 for each Participant. Two Participants were found to be over that average, CWCWD and MCQWD. The study team examined the water use characteristics of these Participants to understand why they exceeded the NISP water use benchmark.

As discussed earlier in this section, CWCWD provides water to various agricultural and dairy users. Nonresidential demands accounted for over 60 percent of total District demand in 2009, with Aurora Dairy and Fort St. Vrain Power Generation representing the largest users. Average residential gpcd between 1999 and 2009 for CWCWD was 168. CWCWD encourages dairy and other agricultural businesses to use non-treated water when possible. As of 2009, more than 30 percent of potable water use in the MCQWD service area was for large dairies. Potable gpcd for residential and commercial averaged 177 between 1999 and 2009.

Residential water use by these Participants is reasonable as compared to the benchmark and as compared to the other Participants. The large water users in these service areas are an integral part of the local economies and are not indicative of a lack of conservation efforts by these Participants.

Summary observations about conservation. All Participants have active conservation programs in place and each include a host of measures. Conservation programs have been expanded and strengthened since 2004. Programs emphasizing price signals appear to be emphasized by Participants. Conservation programs appear to have had an effect in reducing water use among the Participants, although trend data is limited. To the extent there is a NISP water use benchmark, water use patterns of the Participants are not considered excessive. The relatively higher water using Participants are rural water districts that serve large agribusinesses whose effects on water use patterns are magnified by a relatively small population base. This finding suggests that a reasonable level of efficient water use is being practiced by most Participants' customers.

SECTION FOUR
Additional Water Needs of the NISP Participants

Additional water needs of the Participants are determined by the difference between their projected future water demands and their firm annual water supplies or yields that were owned or controlled by the Participants in 2010. That is, as future water demands in a normalized weather condition year exceed firm annual yield, this excess amounts to future water resource needs for a Participant. Unmet future needs refer to a Participant's inability to meet normal demands during water supply circumstances similar to a defined drought period. This approach is consistent with industry standards.

In anticipation of future demands exceeding firm yield, it would be prudent for a water provider to seek additional water supplies. In fact, a water provider can operate assuming average year supplies, which temporarily forestalls the need for additional water resources, but water customers would be faced with drought restrictions more frequently, and the uncertainty or risk of insufficient supplies would be elevated to a level that is not consistent with good water resource management. Therefore, this evaluation focuses on the difference between total future water requirements and present firm annual yields to assess the need for NISP. It is important to note that projected water requirements assume that future water supplies are available to meet demands. Tables IV-1 and IV-2 summarize total future water requirements and shortages beyond firm yields, respectively, by Participant from 2010 through 2060.

Table IV-1.
Projected Water Requirements for NISP Participants in Acre Feet, 2010 to 2060

Participant	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
CWCWD	3,100	4,200	4,700	5,000	5,400	5,900	6,200	6,500	7,100	7,400	7,700
Dacono	580	690	820	970	1,150	1,360	1,620	1,920	2,280	2,710	3,220
Eaton	1,100	1,200	1,300	1,400	1,600	1,800	2,000	2,200	2,500	2,800	3,200
Erie	4,500	7,100	10,000	13,200	16,700	17,500	18,500	19,500	20,800	22,100	23,600
Evans	4,600	5,700	7,000	8,100	9,300	10,100	10,100	10,100	10,100	10,100	10,100
Firestone	2,061	2,927	3,662	4,083	4,508	4,977	5,495	6,067	6,699	7,396	8,166
FCLWD	9,100	10,400	11,800	13,300	14,900	17,000	18,100	18,100	18,100	18,100	18,100
Fort Lupton	3,100	3,200	3,400	3,500	3,700	3,900	4,100	4,400	4,700	4,900	5,300
Fort Morgan	6,600	6,900	7,100	7,300	7,700	8,100	8,400	8,800	9,300	9,800	10,400
Frederick	2,050	2,580	3,110	3,750	4,510	5,440	6,550	7,900	9,520	11,470	13,820
Lafayette	4,500	5,800	7,000	8,200	8,700	8,700	8,700	8,700	8,700	8,700	8,700
LHWD	5,400	6,300	7,400	8,600	10,000	11,700	11,900	11,900	11,900	11,900	11,900
MCQWD	2,100	2,200	2,400	2,700	2,900	3,200	3,500	3,800	4,100	4,400	4,700
Severance	700	1,200	1,900	3,100	3,800	3,800	3,800	3,800	3,800	3,800	3,800
Windsor	2,400	2,900	3,200	3,600	4,100	4,800	5,700	6,700	7,800	9,200	10,700
Total	**51,900**	**63,300**	**74,800**	**86,800**	**99,000**	**108,300**	**114,700**	**120,400**	**127,400**	**134,800**	**143,400**

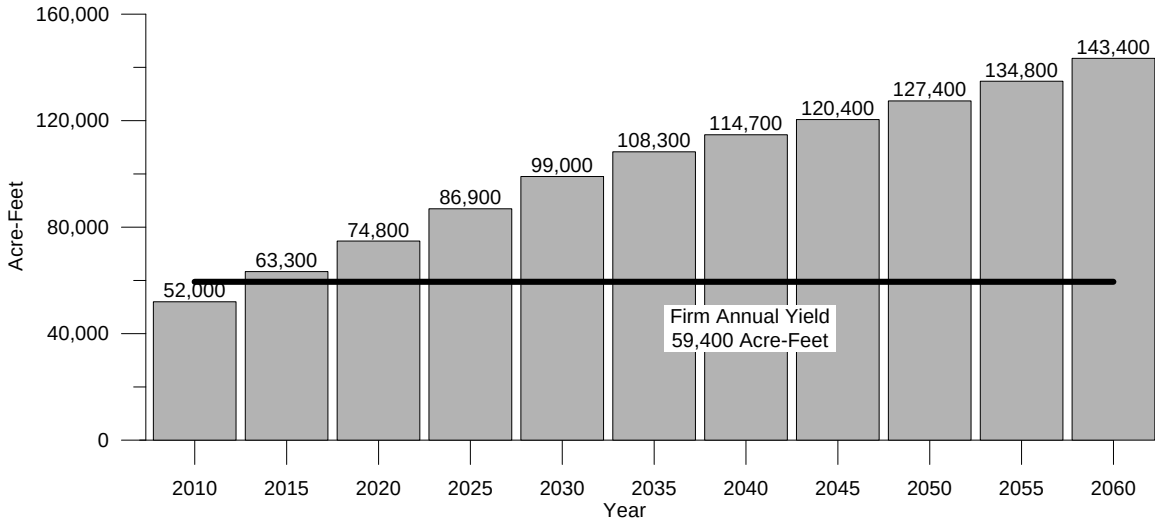
Table IV-2.
Projected Water Shortages beyond Firm Annual Yields for NISP Participants in Acre Feet, 2010 to 2060

Participant	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
CWCWD	(40)	1,100	1,600	1,900	2,300	2,800	3,100	3,400	4,000	4,300	4,600
Dacono	(480)	(400)	(200)	(100)	100	300	600	900	1,200	1,600	2,200
Eaton	(550)	(500)	(400)	(300)	(100)	200	400	600	900	1,200	1,600
Erie	(90)	2,500	5,400	8,600	12,100	12,900	13,900	14,900	16,200	17,500	19,000
Evans	(4,000)	(2,900)	(1,600)	(500)	700	1,500	1,500	1,500	1,500	1,500	1,500
Firestone	(900)	(100)	700	1,100	1,500	2,000	2,500	3,100	3,700	4,400	5,200
FCLWD	(2,300)	(1,000)	400	1,900	3,500	5,600	6,700	6,700	6,700	6,700	6,700
Fort Lupton	1,200	1,300	1,500	1,600	1,800	2,000	2,200	2,500	2,800	3,000	3,400
Fort Morgan	2,600	2,900	3,100	3,300	3,700	4,100	4,400	4,800	5,300	5,800	6,400
Frederick	(1,400)	(800)	(300)	300	1,100	2,000	3,100	4,500	6,100	8,000	10,400
Lafayette	(10)	1,300	2,500	3,700	4,200	4,200	4,200	4,200	4,200	4,200	4,200
LHWD	(400)	500	1,600	2,800	4,200	5,900	6,100	6,100	6,100	6,100	6,100
MCQWD	(800)	(700)	(500)	(200)	0	300	600	900	1,200	1,500	1,800
Severance	60	600	1,300	2,500	3,200	3,200	3,200	3,200	3,200	3,200	3,200
Windsor	(520)	(20)	300	700	1,200	1,900	2,800	3,800	4,900	6,300	7,800
Total	**(7,500)**	**3,900**	**15,400**	**27,400**	**39,500**	**48,900**	**55,200**	**61,000**	**68,000**	**75,400**	**84,000**

Combined Water Needs of the NISP Participants

The water needs of the Participants, viewed as a group, are considerable, as illustrated in Figure IV-1.

Figure IV-1.
Comparison of Future Water Requirements with 2010 Firm Annual Yields for 15 NISP Participants, Combined, in Acre-Feet, 2010 through 2060



By 2015, total future demands of all Participants combined will approximate their combined firm annual yield. By the year 2025, the excess of combined demands over current supplies will be more than 25,000 AF. By 2060, the total shortage for Participants will be more than 80,000 AF. Table IV-3 estimates the projected margins of future demands compared with 2010 firm annual yield of a combined 59,400 AF.

Table IV-3.
Cumulative New Water Requirements beyond 2010 Firm Annual Yield, in Acre-Feet, 2010 through 2060

Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(7,500)
2015	3,900
2020	15,400
2025	27,400
2030	39,500
2035	48,900
2040	55,200
2045	61,000
2050	68,000
2055	75,400
2060	84,000

Note: Firm annual yield for 2010 was estimated to be 61,120 acre-feet for the 15 Participants combined.

The Participants are seeking a permitted yield from NISP totaling 40,000 AF in new firm yield.[10] From a combined standpoint, the Participants will need the yield from NISP no later than 2015, and these Participants will need additional supplies from that time forward. Of course, individual Participants are most likely pursuing multiple strategies for water resource acquisition.

It should be noted that the Participants' future investment in NISP and other water supplies will very likely increase their overall costs per acre-foot of water supplies. If these costs were recovered through volumetric water rates, it is possible that water price elasticity effects would result in reduced consumption, thereby reducing water needs. However, municipalities and most water providers in Northern Colorado have policies that growth must pay its own way. It is quite likely that large portions of the incremental costs of NISP and other new water supplies will be collected in the form of tap fee increases, instead of in water rate increases. Since almost all water costs along the Front Range of Colorado are increasing, it is unlikely that growth or water use will be affected significantly by increases in the cost of water for the Participants.

Future Water Needs of Individual NISP Participants

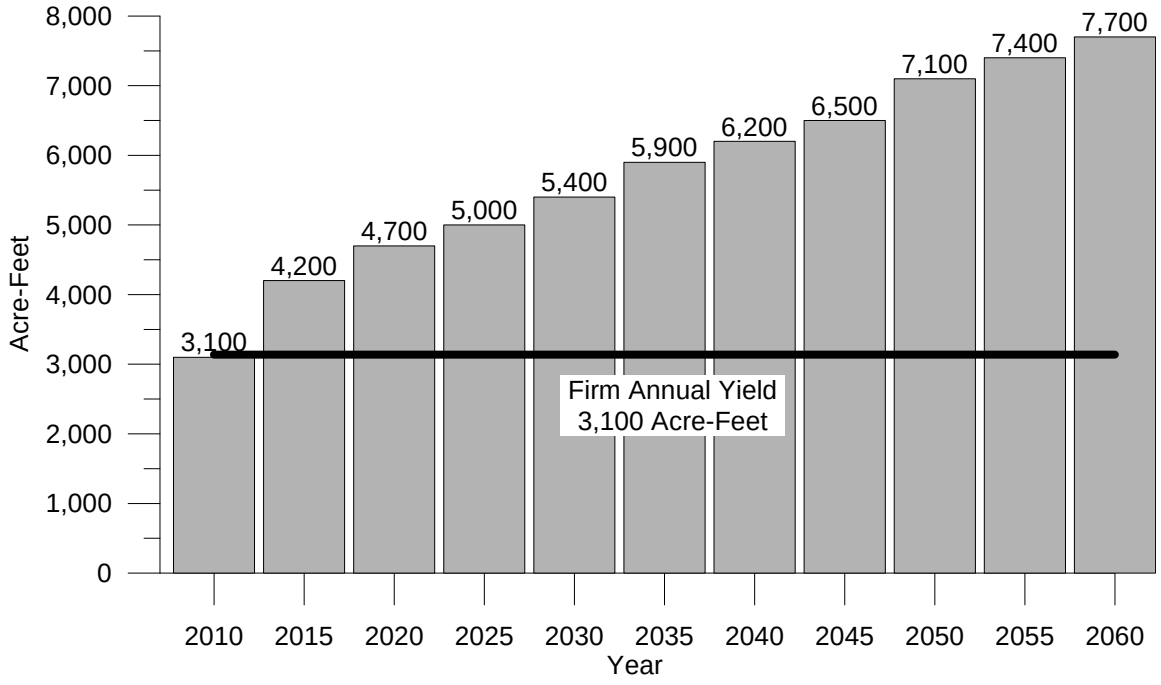
Figures IV-2 through IV-16 present the new water requirements for each Participant beyond their own firm annual yields in 2010. For each Participant, a bar chart comparing future water requirements with 2010 firm annual yield is followed by a table that quantifies the excess supplies or unmet demands for each Participant.

[10] Document obtained from Northern Colorado Water Conservancy District, December 2005.

Central Weld County Water District (CWCWD). With 2010 firm annual yield of almost 3,100 AF, CWCWD is in rough balance with average year demands expected in the year 2010. Projected water demands under normal weather conditions will exceed 2010 firm annual yield in the following year. By 2030, demands will exceed supply by 2,300 AF, by 2060 the shortfall will be about 4,600 AF. CWCWD is seeking 3,500 AF of new permitted firm yield from NISP.

Although CWCWD treats water for the communities of Dacono, Firestone, Frederick, Kersey, Milliken, LaSalle, Gilcrest, Platteville, Left Hand and Aristocrat. CWCWD is currently responsible only for providing treatment and not for supplying the raw water for these communities; therefore, they were not included in the demand evaluation.

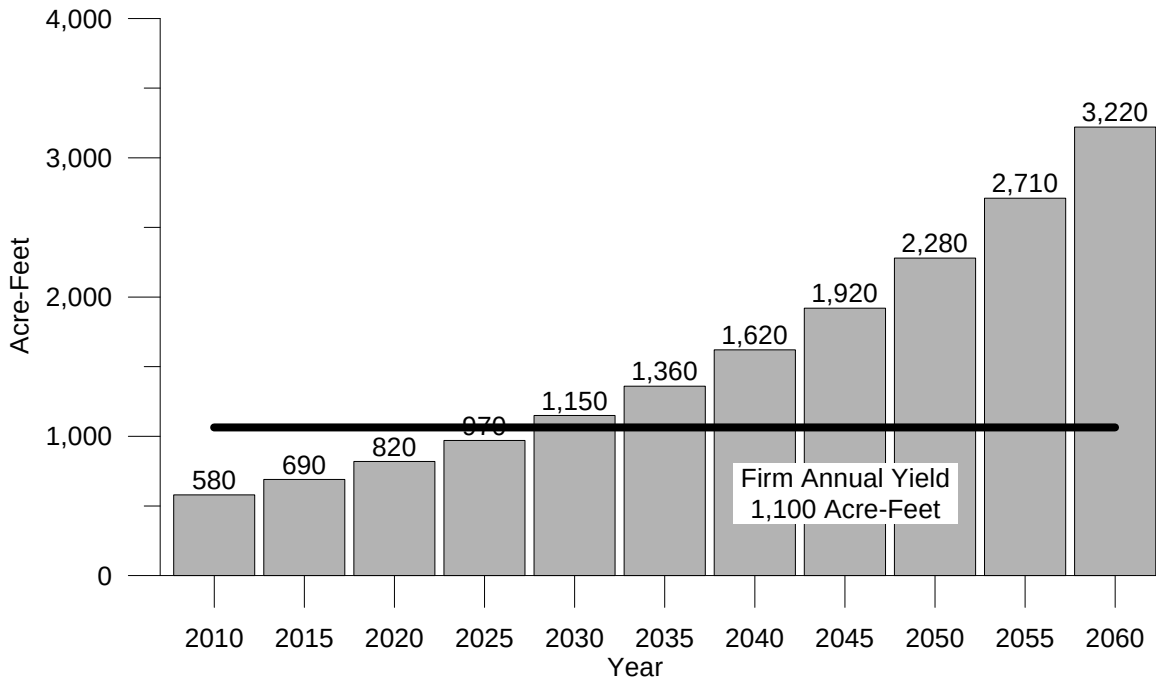
Figure IV-2.
Comparison of Future Water Demands with 2010 Firm Annual Yield, CWCWD, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(40)
2015	1,100
2020	1,600
2025	1,900
2030	2,300
2035	2,800
2040	3,100
2045	3,400
2050	4,000
2055	4,300
2060	4,600

Town of Dacono. The Town of Dacono's future water demands will be adequate with its 2010 firm annual yield of 1,150 AF until about 2030. After that, demands will increase steadily until demand exceeds firm annual yield by more than 2,000 AF in 2060. Dacono is seeking 1,000 AF of new permitted firm yield from NISP.

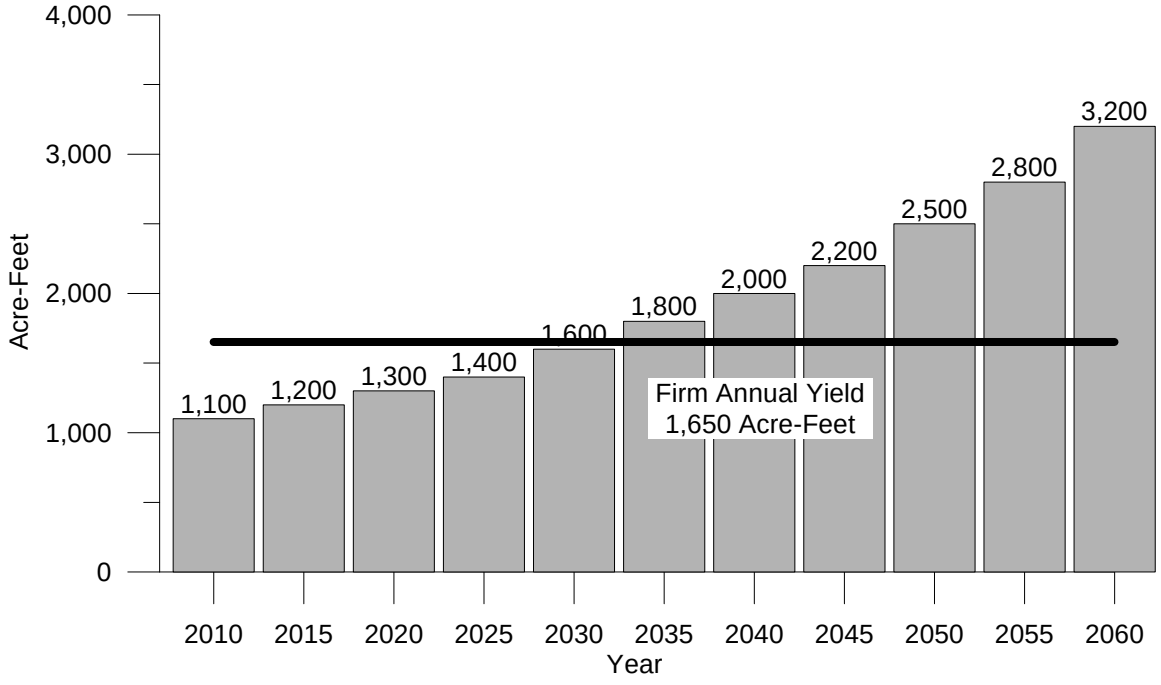
Figure IV-3.
Comparison of Future Water Demands with 2010 Firm Annual Yield, Town of Dacono, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(480)
2015	(370)
2020	(240)
2025	(90)
2030	90
2035	300
2040	560
2045	860
2050	1,220
2055	1,650
2060	2,160

Town of Eaton. The Town of Eaton's future water demands will be adequate with its 2010 firm annual yield of 1,650 AF until about 2030. By the year 2040, the Town of Eaton is projected to need about 350 AF in new, firm annual yield. By 2060, that figures rises to 1,550 AF. Eaton is seeking 1,300 AF of new permitted firm yield from NISP.

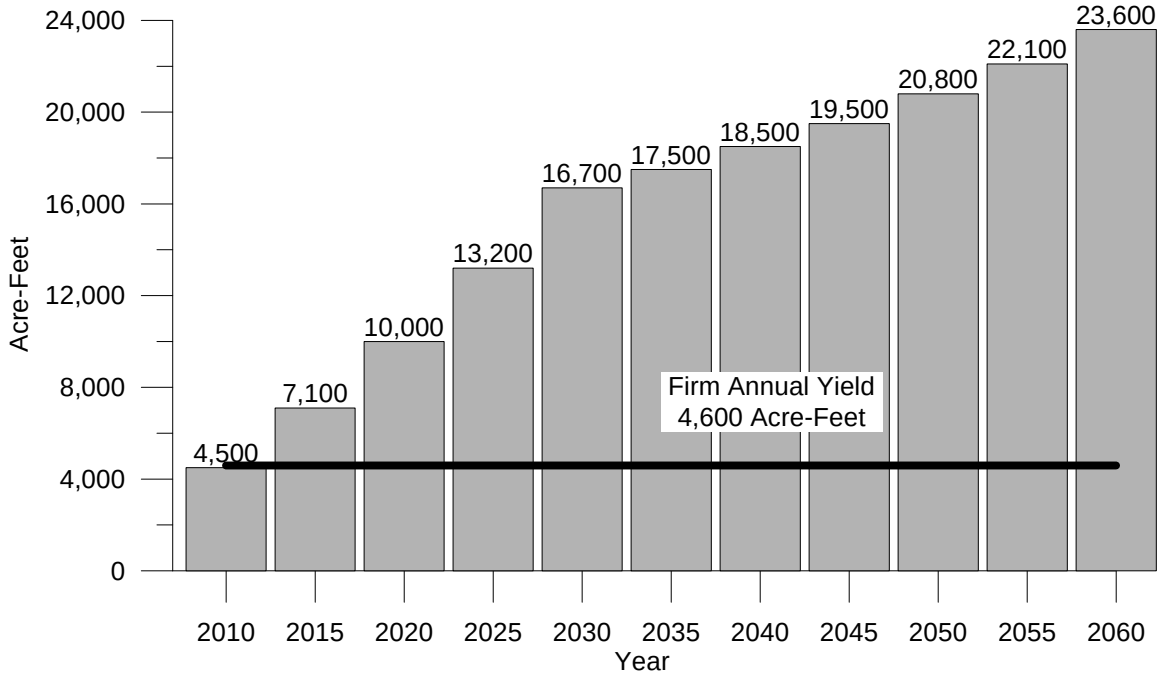
Figure IV-4.
Comparison of Future Water Demands with 2010 Firm Annual Yield, Town of Eaton, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(550)
2015	(450)
2020	(350)
2025	(250)
2030	(50)
2035	150
2040	350
2045	550
2050	850
2055	1,150
2060	1,550

Town of Erie. The Town of Erie has a 2010 firm annual yield of about 4,600 AF and is in rough balance with water demands expected for the year 2010. The Town of Erie will need additional firm annual yield shortly thereafter, and this excess of demands over 2010 water supplies will increase rapidly. By 2030, the demand will exceed firm supplies by more than 12,000 AF and by 2060 that shortfall will increase to 19,000 AF. Erie is seeking 6,500 AF of new permitted firm yield from NISP.

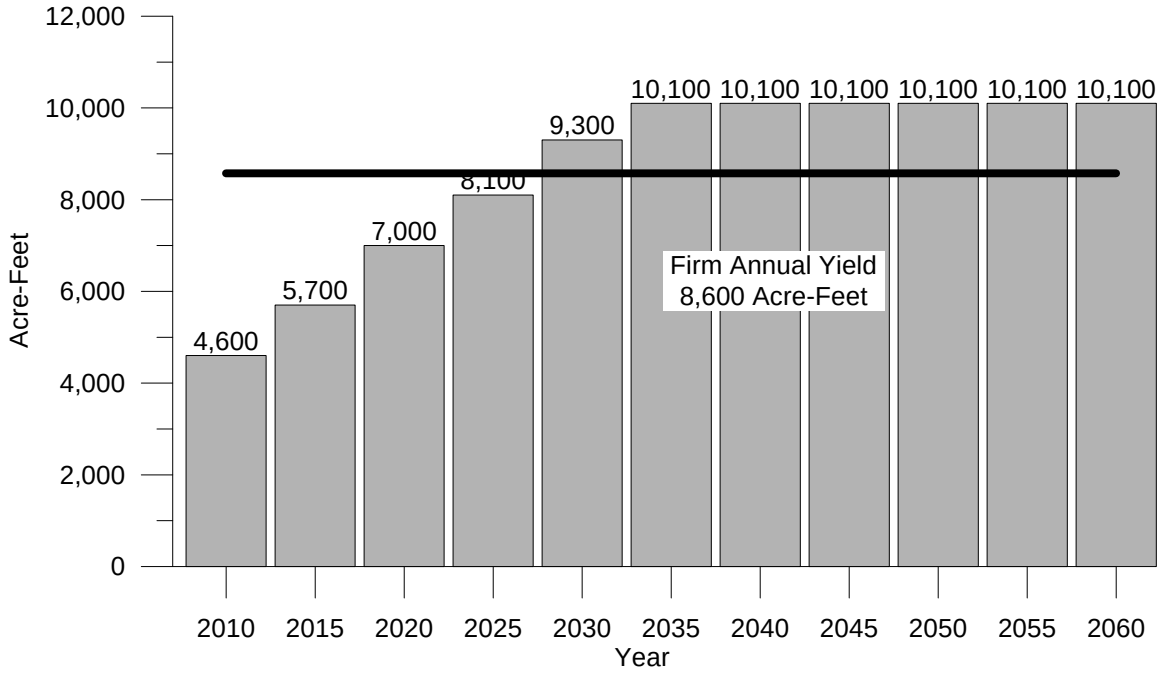
Figure IV-5.
Comparison of Future Water Demands with 2010 Firm Annual Yield, Town of Erie, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(90)
2015	2,500
2020	5,400
2025	8,600
2030	12,100
2035	12,900
2040	13,900
2045	14,900
2050	16,200
2055	17,500
2060	19,000

City of Evans. The City of Evans obtains treated water from the City of Greeley but must provide Greeley with the underlying water resources to meet that need. Evans' firm annual yield in 2010 was estimated at about 8,600 AF, including non-potable supplies that were available only for non-potable deliveries. The City of Evans faces an excess of demands over its supplies in coming years, reaching a deficit of 700 AF by the year 2030 and 1,600 AF in 2035, about which time the city should reach buildout. The City of Evans is seeking 1,600 AF of new permitted firm yield from NISP.

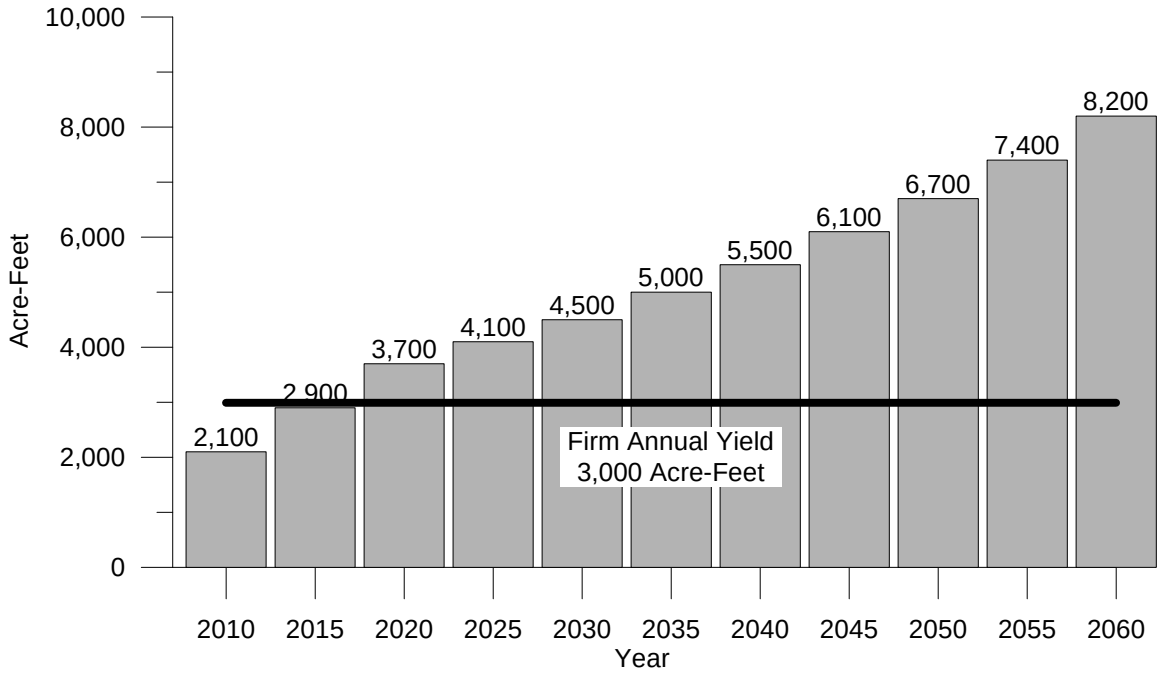
Figure IV-6.
Comparison of Future Water Demands with 2010 Firm Annual Yield, City of Evans, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(4,000)
2015	(2,900)
2020	(1,600)
2025	(500)
2030	700
2035	1,500
2040	1,500
2045	1,500
2050	1,500
2055	1,500
2060	1,500

Town of Firestone. The Town of Firestone will have adequate firm annual yield until about 2015, after which shortages will steadily increase. By 2030, firm annual yield will be about 1,500 AF less than projected demands. Firestone's firm annual yield will be more than 5,000 AF less than demand by 2060. Firestone is seeking 1,300 of new permitted firm yield from NISP.

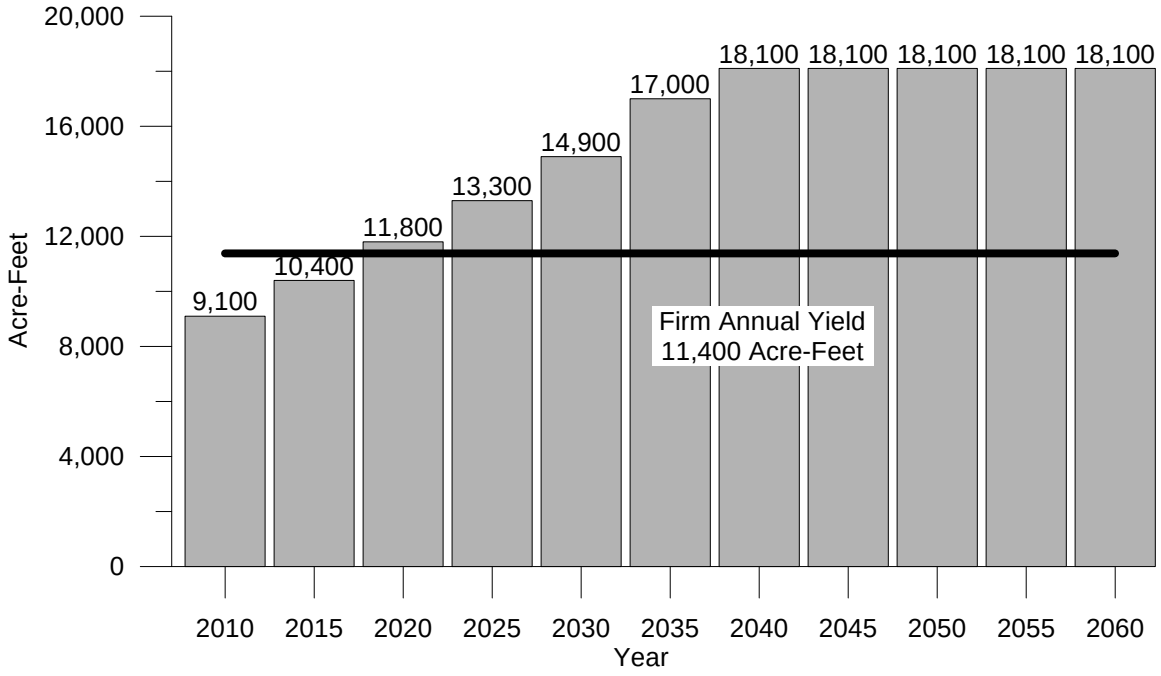
Figure IV-7.
Comparison of Future Water Demands with 2010 Firm Annual Yield, Town of Firestone, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(900)
2015	(60)
2020	700
2025	1,100
2030	1,500
2035	2,000
2040	2,500
2045	3,100
2050	3,700
2055	4,400
2060	5,200

Fort Collins-Loveland Water District (FCLWD). With a 2010 firm annual yield of about 11,400 AF, FCLWD will have adequate supply until 2020. After that, shortages will develop and grow steadily to 6,700 AF at buildout, which is projected to be reached around 2040. FCLWD is seeking 3,000 AF of new permitted firm yield from NISP.

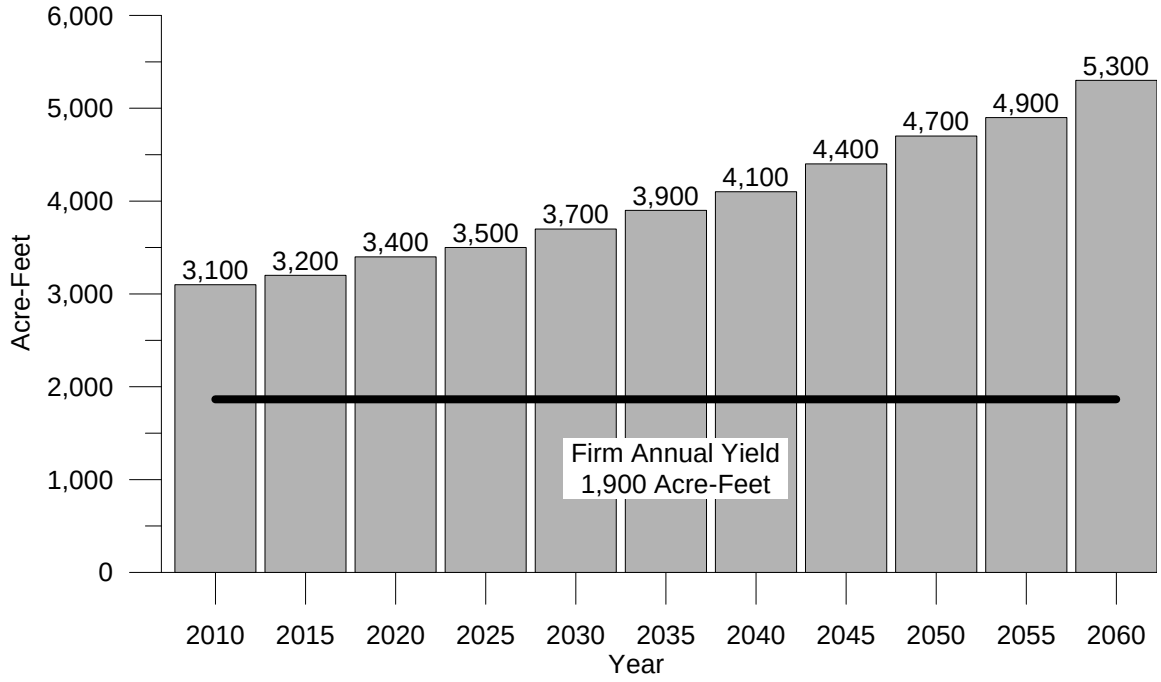
Figure IV-8.
Comparison of Future Water Demands with 2010 Firm Annual Yield, FCLWD, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(2,300)
2015	(1,000)
2020	400
2025	1,900
2030	3,500
2035	5,600
2040	6,700
2045	6,700
2050	6,700
2055	6,700
2060	6,700

The City of Fort Lupton. The City of Fort Lupton had a 2010 firm annual yield of almost 1,900 AF, which suggests that the city faces immediate shortages. The excess of Fort Lupton's future water demands compared with its firm annual yield will rise slowly but steadily to reach 1,600 AF by the year 2025 and more than 3,000 AF by the year 2060. The City of Fort Lupton is seeking 3,000 AF of new permitted firm yield from NISP.

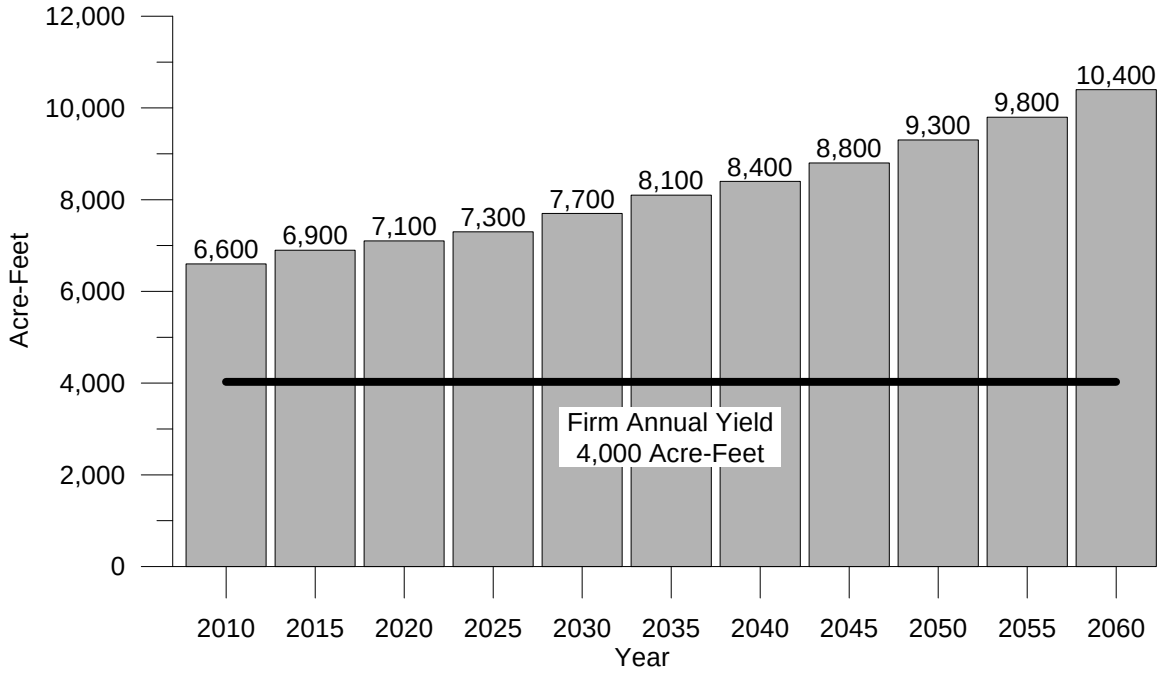
Figure IV-9.
Comparison of Future Water Demands with 2010 Firm Annual Yield, Town of Fort Lupton, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	1,200
2015	1,300
2020	1,500
2025	1,600
2030	1,800
2035	2,000
2040	2,200
2045	2,500
2050	2,800
2055	3,000
2060	3,400

City of Fort Morgan. With just over 4,000 AF of 2010 firm annual yield, the City of Fort Morgan could experience shortages in the immediate future. Fort Morgan's need for new water supplies will grow steadily, reaching 3,300AF in the year 2025 and 6,400 AF in 2060. Fort Morgan is seeking 3,600 AF of new permitted firm yield from NISP.

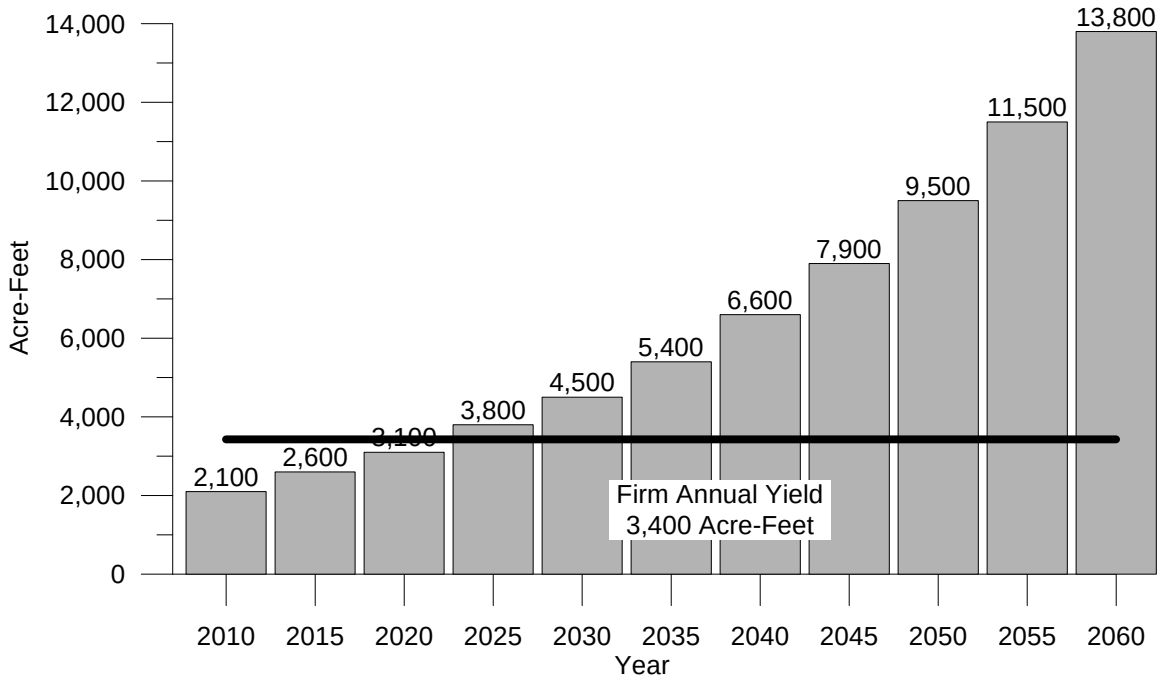
Figure IV-10.
Comparison of Future Water Demands with 2010 Firm Annual Yield, City of Fort Morgan, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	2,600
2015	2,900
2020	3,100
2025	3,300
2030	3,700
2035	4,100
2040	4,400
2045	4,800
2050	5,300
2055	5,800
2060	6,400

Town of Fredrick. The Town of Frederick's projected water demands in 2010 are about 1,400 AF less than its 2010 firm annual yield of about 3,400 AF. Supplies will be adequate until about 2025, after which shortages will growly at a rapid pace, reaching more than 10,000 AF by year 2060. The Town of Frederick is seeking 2,600 AF of new permitted firm yield from NISP.

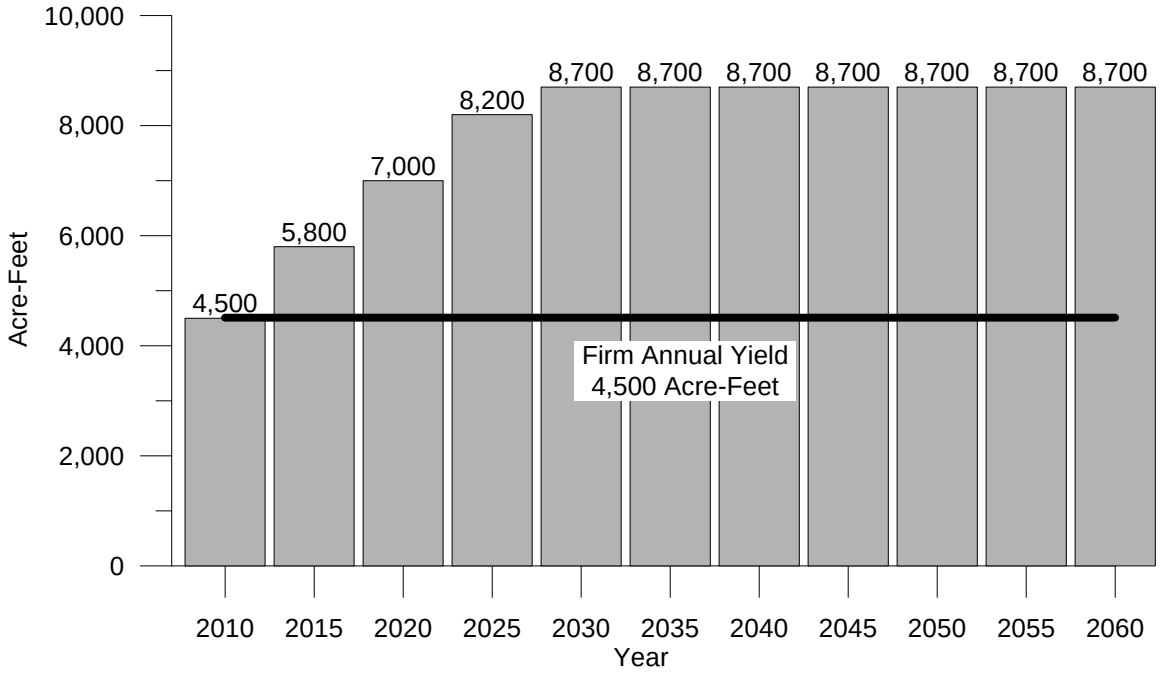
Figure IV-11.
Comparison of Future Water Demands with 2010 Firm Annual Yield, Town of Frederick, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(1,400)
2015	(800)
2020	(300)
2025	300
2030	1,100
2035	2,000
2040	3,100
2045	4,500
2050	6,100
2055	8,000
2060	10,400

City of Lafayette. The City of Lafayette's projected water demands in 2010 are in rough balance with its 2010 firm annual yield of about 4,500 AF. From there, the excess of projected demands over 2004 supplies will increase, reaching more than 4,200 AF by the year 2030, when buildout is achieved. The City of Lafayette is seeking 1,800 AF of new permitted firm yield from NISP.

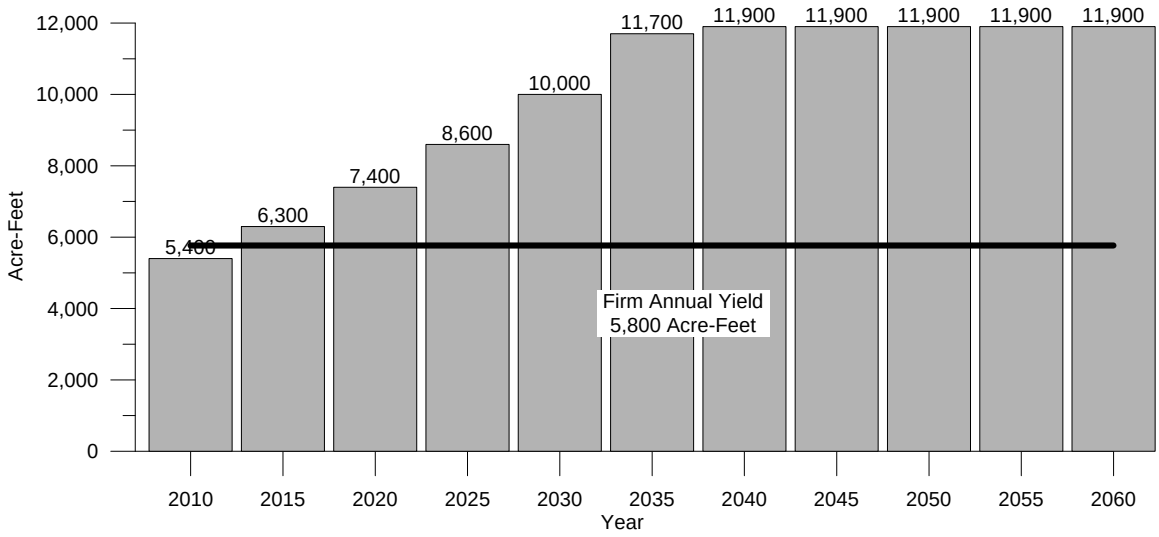
Figure IV-12.
Comparison of Future Water Demands with 2010 Firm Annual Yield, City of Lafayette, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(10)
2015	1,300
2020	2,500
2025	3,700
2030	4,200
2035	4,200
2040	4,200
2045	4,200
2050	4,200
2055	4,200
2060	4,200

Left Hand Water District (LHWD). LHWD's 2010 firm annual yield of about 5,800 AF will meet average year water demands projected through the year 2010, but supply will be less than demand within the next two to three years. The need for new firm annual yield will grow after that, reaching 6,100 AF at buildout, by the year 2040. LHWD is seeking 4,900 AF of new permitted firm yield from NISP.

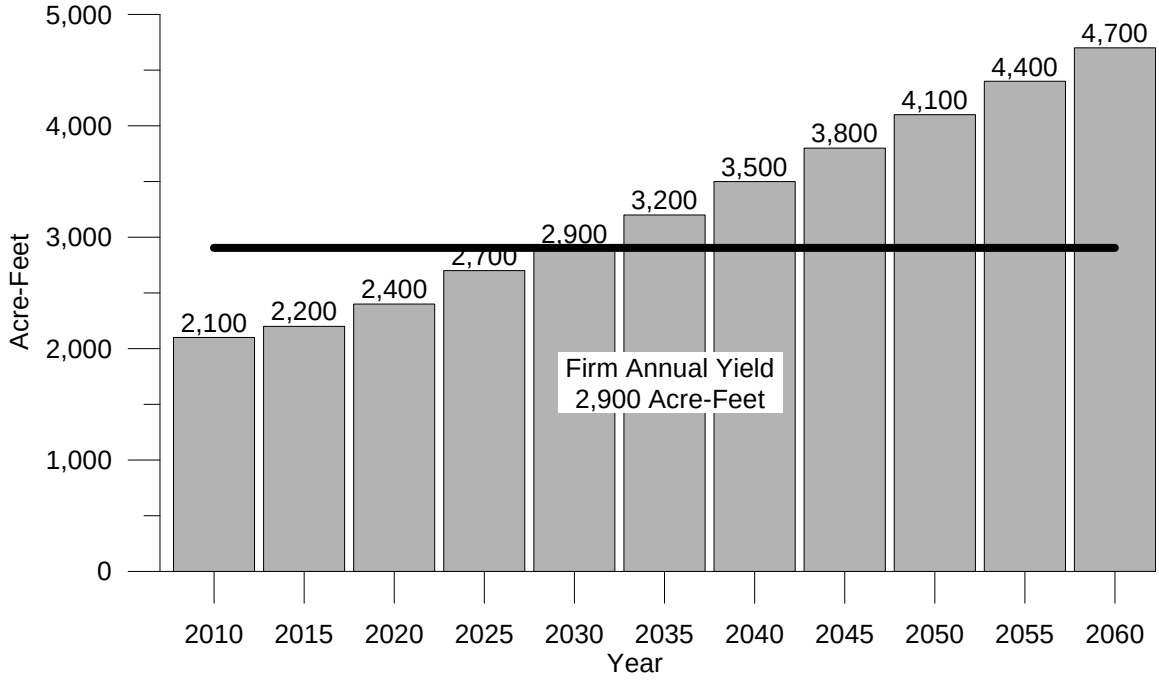
Figure IV-13.
Comparison of Future Water Demands with 2010 Firm Annual Yield, Left Hand Water District, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(400)
2015	500
2020	1,600
2025	2,800
2030	4,200
2035	5,900
2040	6,100
2045	6,100
2050	6,100
2055	6,100
2060	6,100

Morgan County Quality Water District (MCQWD). This water district, with almost 2,900 AF in 2010 firm annual yield, will be able to meet projected demands through the year 2030. After that, the need for new water resources will gradually increase, reaching 1,800 AF by the year 2060. MCQWD is seeking 1,300 AF of new permitted firm yield from NISP.

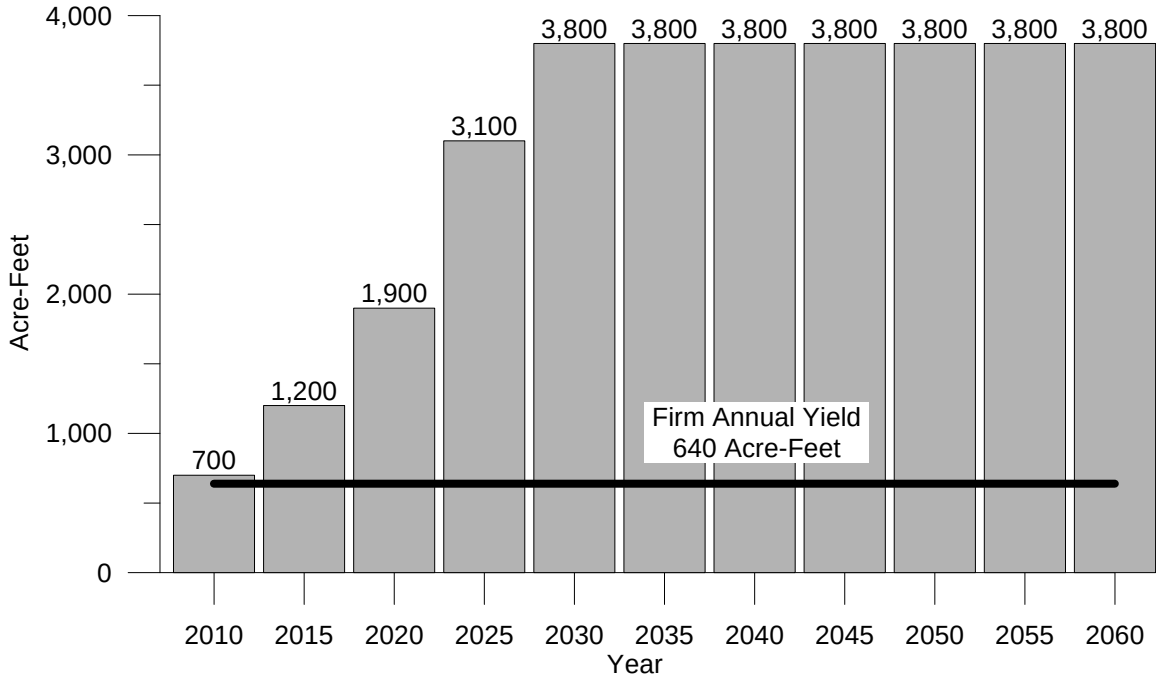
Figure IV-14.
Comparison of Future Water Demands with 2010 Firm Annual Yield, Morgan County Quality Water District, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(800)
2015	(700)
2020	(500)
2025	(200)
2030	0
2035	300
2040	600
2045	900
2050	1,200
2055	1,500
2060	1,800

The Town of Severance. The Town of Severance's 2010 firm annual yield of 640 AF is less than projected demands for 2010. New water resource needs for the Town of Severance will grow relatively rapidly, reaching 2,500 AF by 2025. By 2030, when buildout is projected to occur, the shortage will be 3,200 AF. The Town of Severance is seeking 1,300 AF of new permitted firm yield from NISP.

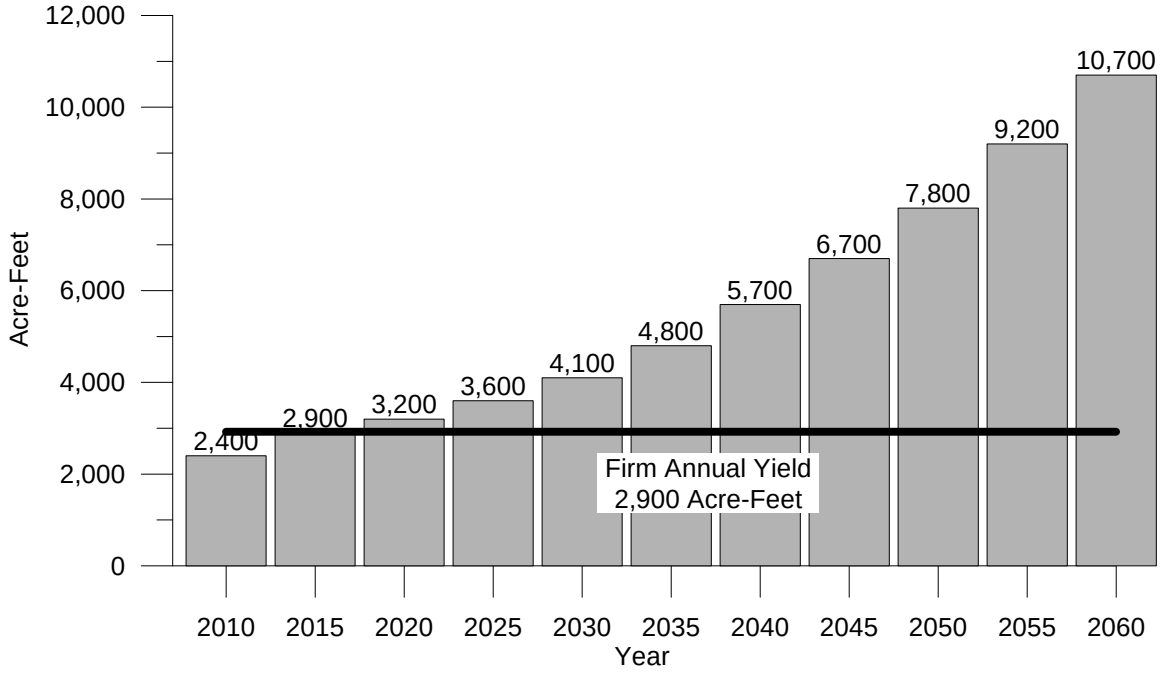
Figure IV-15.
Comparison of Future Water Demands with 2010 Firm Annual Yield, Town of Severance, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	60
2015	600
2020	1,300
2025	2,500
2030	3,200
2035	3,200
2040	3,200
2045	3,200
2050	3,200
2055	3,200
2060	3,200

Town of Windsor. With 2010 firm annual yield of a little more than 2,900 AF, the Town of Windsor's water demands projected for the year 2010 are about 500 AF less than its supply, but new water supplies will be required in the near future. Windsor's need to secure new water resources will grow, reaching 1,200 AF by the year 2030. The Town of Windsor is seeking 3,300 AF of new permitted firm yield from NISP.

Figure IV-16.
Comparison of Future Water Demands with 2010 Firm Annual Yields, Town of Windsor, in Acre-Feet, 2010 through 2060



Year	Cumulative Water Requirements beyond 2010 Firm Annual Yield
2010	(520)
2015	(20)
2020	300
2025	700
2030	1,200
2035	1,900
2040	2,800
2045	3,800
2050	4,900
2055	6,300
2060	7,800

Conclusions about the Need for NISP

The study team performed a careful analysis of existing supplies and projected water demands for each of the 15 Participants in NISP. In each instance, the Participants have projected new water resource needs that justify their participation in this project. For many Participants, additional water resources should also be identified in the near future.

By 2015, the total future demand of all Participants combined will exceed their combined firm annual yield. By the year 2025, the excess of combined demands over current supplies will approximate 27,400 AF. The Participants are seeking from NISP a combined 40,000 AF in new permitted firm yield.[11] Between 2030 and 2035, these Participants will need additional supplies beyond NISP. Of course, individual Participants are most likely pursuing multiple strategies for water resource acquisition.

[11] Northern Colorado Water Conservancy District, 2006 Phase III Participation and Budget, December 2005.

APPENDIX A
CENTRAL WELD COUNTY WATER DISTRICT
Water Demands

The Central Weld County Water District (CWCWD) currently supplies water to rural customers within its district boundaries and treats water for the communities of Dacono, Firestone, Frederick, Kersey, Milliken, LaSalle, Gilcrest, Platteville, Left Hand and Aristocrat. CWCWD is currently responsible only for providing treatment and not for supplying the raw water for these communities; therefore, they were not included in the demand evaluation. CWCWD's service area is approximately 250 square miles, all within Weld County.

Historical Water Demands

CWCWD's service area population was estimated at 5,750 persons in 2010.[1] Exhibit A-1 presents the District's population and numbers of taps from 1999 through 2010 by customer type.

Exhibit A-1.
CWCWD Population and Water Tap Change, 1999 through 2010

Year	Population	Residential Taps	Nonresidential Taps	Total Taps	Annual Percent Change
1999	4,075	1,363	119	1,482	N.A.
2000	4,972	1,663	130	1,793	21.0%
2001	5,047	1,688	133	1,821	1.6%
2002	5,197	1,738	137	1,875	3.0%
2003	5,307	1,775	140	1,915	2.1%
2004	5,421	1,813	143	1,956	2.1%
2005	5,526	1,848	146	1,994	1.9%
2006	5,640	1,886	149	2,035	2.1%
2007	5,665	1,895	149	2,044	0.4%
2008	5,712	1,910	151	2,061	0.8%
2009	5,732	1,917	151	2,068	0.3%
2010	5,751	1,923	152	2,075	0.3%

Note: The District's population was estimated by applying 2.99 persons per residential tap, the average household size observed in census tract 18 in Weld County in 2000, US Census Bureau.

Source: The Engineering Company, *Water System Master Plan for Central Weld County Water District*, June 2003. US Census Bureau, 2000 decennial census, accessed November 2004. CWCWD, 2010.

[1] CWCWD response to NISP Questionnaire from Northern Colorado Water Conservancy District, June 2010.

From 1999 through 2010, CWCWD's total taps increased by 40 percent, or at an average annual rate of 3.1 percent.

Potable water demands. Exhibit A-2 provides the District's historical potable water use by customer type for 1999 through 2009.

Exhibit A-2.
Historic Water Use for CWCWD, in Millions of Gallons

Year	Residential	Nonresidential	Total	Annual Percent Change
1999	295	597	891	N.A.
2000	280	619	899	0.9%
2001	326	588	914	1.7%
2002	335	575	910	-0.4%
2003	330	567	897	-1.5%
2004	310	533	844	-5.9%
2005	284	527	811	-3.9%
2006	359	579	939	15.8%
2007	351	543	893	-4.8%
2008	387	515	902	0.9%
2009	312	488	800	-11.2%

Source: The Engineering Company, *Water System Master Plan for Central Weld County Water District*, June 2003. CWCWD, 2010.

CWCWD's total potable water deliveries decreased by 10 percent from 1999 through 2009, or at an average annual rate of -1.1 percent. However, 2009 had the lowest water use over the entire eleven year period. CWCWD's water use from 1999 to 2008 increased by 1.2 percent or at an average annual rate of 0.1 percent, more slowly than both tap growth and population growth from 1990 through 2009.

Nonresidential demands accounted for over 60 percent of total District demand in 2009. Nonresidential demand is mostly attributable to various agricultural and dairy users, with Aurora Dairy and Fort St. Vrain Power Generation representing the largest users.[2] Nonresidential water use decreased by more than 10 percent from 1999 to 2009, while the total number of nonresidential taps grew by approximately 27 percent during this period. In 2009, annual nonresidential use per tap was 3.2 million gallons.

While the majority of the District's use is agricultural, CWCWD has experienced growth in both the number of residential taps and use in recent years. From 1999 to 2008, the district's residential water sales increased by over 30 percent (residential water sales only increased by 6 percent if the 2009 value is used), and its share of total use increased by over 5 percent. Over this period, the total number of residential taps grew by 3.2 percent per year on average.

[2] CWCWD response to NISP Questionnaire from Northern Colorado Water Conservancy District, June 2010.

Exhibit A-3 provides CWCWD's residential and total potable water use per capita and per residential and total tap per day for 1999 through 2002.

Exhibit A-3.
CWCWD's Potable Gallons per Capita and per Residential and Total Tap per Day

Year	Residential Use per Capita	Total Use per Capita	Residential Use per Residential Tap	Total Use per Total Tap
1999	198	599	593	1,646
2000	154	495	461	1,373
2001	177	496	529	1,375
2002	177	480	528	1,330
2003	170	463	509	1,283
2004	157	426	469	1,182
2005	141	402	420	1,114
2006	175	456	522	1,264
2007	170	432	507	1,197
2008	185	432	554	1,198
2009	149	382	447	1,060

Source: Figures are based on the data presented in Exhibits A-1 and A-2.

Residential and total water use per capita per day averaged 168 and 460 gallons, respectively, from 1999 through 2009. Water use per residential tap decreased from 593 gallons per day in 1999 to 447 gallons per day in 2009. Residential and total gallons per residential and total tap averaged 504 and 1,275 gallons, respectively. Numerous large nonresidential users drive the total water use per capita and per total tap higher than other water providers in the region.

Non-potable water demands. CWCWD does not serve any non-potable water demands.

Total water requirements. Exhibit A-4 presents CWCWD's total water requirements from 1999 through 2009.

Exhibit A-4.
Total Water Requirements for CWCWD, in Millions of Gallons and Acre-Feet, 1999 to 2009

Year	Potable MG	Non-potable MG	Total Water Deliveries MG	Total Water Deliveries AF	Total Water Requirements AF
1999	891	0	891	2,733	2,927
2000	899	0	899	2,758	2,954
2001	914	0	914	2,804	3,003
2002	910	0	910	2,794	2,992
2003	897	0	897	2,752	2,947
2004	844	0	844	2,589	2,773
2005	811	0	811	2,488	2,665
2006	939	0	939	2,881	3,086
2007	893	0	893	2,742	2,936
2008	902	0	902	2,767	2,963
2009	800	0	800	2,455	2,630

Source: The Engineering Company, *Water System Master Plan for Central Weld County Water District*, June 2003.
Harvey Economics, 2004.

Total water requirements reflect an adjustment of 6.6 percent for system losses. Total water requirements decreased 10 percent from 1999 through 2009, or at an average annual rate of -1.1 percent. The corresponding values using 2008 as the end year are an increase of 1.2 percent in total water requirements and an average annual rate of one-tenth of one percent.

Projected Water Requirements

CWCWD provided the study team with forecasts of future water demands through 2030. These projections were prepared by The Engineering Company (TEC) for the District's 2003 Water Master Plan. Projections were based on forecasted residential tap growth combined with average annual use per tap. Again, the ten small communities within the CWCWD are assumed to continue providing their own water supplies, and are therefore excluded from the projections.

TEC's analysis of annual residential tap sales from 1997 through 2002 suggested future growth would occur at a base rate of 60 residential taps per year.[3] The total number of residential taps has grown by an average of 54 taps per year since 1999. Given the small numbers involved and the availability of land to accommodate this growth, this base rate growth assumption is considered reasonable.

In addition, CWCWD has agreed to provide developers of the Beebe Draw subdivision up to 201 acre-feet to meet their demand to buildout.[4] Initial tap sales have amounted to 59 acre-feet, leaving 142 acre-feet of water demand CWCWD is obligated to supply. It is assumed

[3] The Engineering Company, *Water System Master Plan for Central Weld County Water District*, June 2003.
[4] Mike Upchurch, CWCWD, November 2010.

that this subdivision would reach build out by the year 2020. This assumption is reasonable given Beebe Draw plans and rural county growth prospects.

Due to the difficulty associated with predicting changes to its commercial, industrial and agricultural customer base, the CWCWD analysis did not include formal projections of nonresidential demands, but the District believes its non-residential demands will grow.[5] Projections of nonresidential demands were calculated in a manner consistent with the approach taken by TEC in the *Water System Master Plan*. Over the period 1992 to 2002, the total number of nonresidential taps grew by an average of 3.5 new taps per year.[6] For the purposes of projecting nonresidential demand, it was assumed that the total number of nonresidential taps would continue to increase by 3.5 per year.

Exhibit A-5 presents future residential and nonresidential tap growth and the average annual rate of growth for each period through 2060. Tap growth begins with the assumption of 50 new taps per year, which is the long term average growth in the District. Of course, some years will be higher and others will be lower, but on average, this is a reasonable expectation.[7] The taps are split into residential and nonresidential using historical percentages. This corresponds to an average annual growth rate of 1.2 percent over the 2010 to 2060 period. For comparison, during the period 1999 to 2009 (presented in Exhibit A-1), the total number of taps grew at an average annual rate of 3.1 percent per year.

Exhibit A-5.
Projected Residential and Nonresidential Taps for CWCWD, 2010 through 2060

Year	Residential Taps	Average Annual Rate of Growth	Nonresidential Taps	Average Annual Rate of Growth	Population	Average Annual Rate of Growth
2010	1,900	N.A.	150	N.A.	5,800	N.A.
2015	2,100	2.0%	170	2.5%	6,400	2.0%
2020	2,400	2.7%	190	2.2%	7,100	2.1%
2025	2,600	1.6%	210	2.0%	7,800	1.9%
2030	2,800	1.5%	230	1.8%	8,500	1.7%
2035	3,100	2.1%	250	1.7%	9,200	1.6%
2040	3,300	1.3%	270	1.6%	9,900	1.5%
2045	3,500	1.2%	290	1.4%	10,600	1.4%
2050	3,800	1.7%	300	0.7%	11,300	1.3%
2055	4,000	1.0%	320	1.3%	12,000	1.2%
2060	4,200	1.0%	340	1.2%	12,700	1.1%

Source: Harvey Economics, 2010; CWCWD 2010.

To arrive at projected residential demand, historical residential water use patterns were analyzed. Based on historical averages, it was assumed that each residential tap would require an additional 840,000 gallons of annual demand, or 504 gallons per day. This

[5] Further support for this conclusion is provided in the *Water System Master Plan,* which cites the availability of land and the presence of a reliable water source as likely reasons for continued growth within the District's agricultural customer base.

[6] Personal email communication with Tom Ullman, The Engineering Company, September 2004, attached file: CWRetailuse.xls.

[7] Mike Upchurch, CWCWD, November 2010.

amounts to an assumed 168 gallons per capita per day. Projected residential demand was calculated as the product of gallons per tap and the total number of residential taps.

Nonresidential water demand was calculated by subtracting residential demand from total demand. Total demand was calculated in a similar way to residential demand. Each tap would require an additional 465,000 gallons of annual demand, or 1,275 gallons per day. Again, projected total demand was calculated as the product of gallons per tap and the total number of taps. Nonresidential demand was calculated as the difference between total demand and residential demand.

In addition to normal non-residential growth, CWCWD is like to experience an increase in large water users. As of 2010, the District contained eight dairy farms which required an average of about 700 acre-feet of water each. The Leprino Cheese Company will complete its first phase of a new large plant in Greeley that will require milk supplies from as many as 80,000 dairy cows eventually.[8] The District is well located for new dairy operations or expansions of existing operations to serve this new demand. It is fair to assume that the equivalent of at least one new dairy operation with a 1,000 or more cows will be established within the CWCWD, and this will add an additional 700 acre feet of demand. It is also possible the District will attract methane processors to extract methane from animal waste, but this is not reflected in the projections.

Total water requirements. Exhibit A-6 provides projected CWCWD residential, nonresidential and total water requirement projections for the period 2010 to 2060, including average annual growth rates.[9]

Exhibit A-6.
Projected Water Demands for CWCWD, in Acre-Feet
2010 through 2060

Year	Residential	Nonresidential	Total Potable	Non-potable	Total Water Deliveries	Total Water Requirements	Average Annual Growth
2010	1,100	1,800	2,900	0	2,900	3,100	N.A.
2015	1,200	2,700	3,900	0	3,900	4,200	6.3%
2020	1,400	3,000	4,400	0	4,400	4,700	2.3%
2025	1,500	3,200	4,700	0	4,700	5,000	1.2%
2030	1,600	3,400	5,000	0	5,000	5,400	1.6%
2035	1,700	3,800	5,500	0	5,500	5,900	1.8%
2040	1,900	3,900	5,800	0	5,800	6,200	1.0%
2045	2,000	4,100	6,100	0	6,100	6,500	0.9%
2050	2,100	4,500	6,600	0	6,600	7,100	1.8%
2055	2,300	4,600	6,900	0	6,900	7,400	0.8%
2060	2,400	4,800	7,200	0	7,200	7,700	0.8%

Source: Harvey Economics, 2010.

[8] *Denver Post*, August 26, 2010.
[9] By comparison, over the period 1992 to 2002 the District's total annual demand grew at an average annual rate of 3.6 percent.

Total water requirements include approximate system losses of 7 percent. These projections are consistent with recent use trends within the District. Projected residential use is stable as a percentage of total use, accounting for slightly more than one third of total demand.

CWCWD is currently responsible for securing raw water supplies only for the rural customers in its service area. The projections provided in Exhibit A-6 reflect only the future demands of these rural customers. At present, CWCWD is not responsible for securing the raw water necessary to meet future demands for the communities of Dacono, Firestone, Frederick, Kersey, Milliken, LaSalle, Gilcrest, Left Hand and Aristocrat. If, at some point, the District assumes this responsibility, these projections in Exhibit A-6 will greatly understate the District's actual needs.[10] Since these communities are small, but likely to need water in the future, it is quite possible that CWCWD might serve them with new water supplies.

Conservation

In 2003, CWCWD developed a Water Conservation Plan to "(1) raise the awareness level of all water users within the District to conserve water at every level of use, (2) to encourage all District water users to use water more efficiently, and (3) to satisfy the requirements of the 'Water Conservation Act of 1991'."11 The plan was updated in April of 2005. The plan includes the following conservation measures:

- Publication of District newsletters that promote voluntary upgrades to water efficient fixtures and appliances;
- Dissemination of educational materials regarding efficient irrigation techniques; and
- Plans to establish a library of water efficient literature available to all CWCWD customers.

Since 1988, the District has also utilized an advanced leak detection system to reduce inefficiencies in the distribution of its supplies. All water entering and leaving the distribution system is monitored, and flow levels are reported every 2.5 minutes. Such a system allows the district to immediately detect and repair leaks. In addition, the District regularly upgrades its distribution lines to improve system efficiency and reliability.

[10] Conversation with John Zadel, CWCWD, November 2004.
[11] CWCWD, *Water Conservation Plan*, 2005, p.2.

APPENDIX B
DACONO
Water Demand

The City of Dacono is located in southwestern Weld County, about 10 miles north of the Denver metropolitan area. The area outside Dacono city limits is under the jurisdiction of Weld County. To avoid conflicts between City and County jurisdictions, Weld County has established Intergovernmental Agreements (IGAs), which establish planning areas within Urban Growth Areas of the County. Dacono's planning area is about 22 square miles, or 14,080 acres, and is bounded by State Highway 52 on the north, Weld County Road (WCR) 21 on the east, WCR 6 on the south and Interstate 25 on the west.

Dacono receives all of its treated water through a water supply agreement with the Central Weld County Water District, in which Dacono is responsible for securing raw water supplies. The City distributes that treated water to residential, commercial and industrial customers within the historical City limits and in areas within the planning area recently annexed by the City. In 2009, the City served 1,535 water taps and had a service area population of about 4,300 people.

Historical Water Demands

Exhibits B-1 and B-2 provide the historical population, historical number of water taps and annual growth rates for each from the years 1990 to 2009. Between 1990 and 2009, the population of Dacono almost doubled. Average annual population growth was approximately 3.5 percent.

Exhibit B-1.
City of Dacono Population, 1990 to 2009

Year	Population	Annual Growth
1990	2,228	NA
1991	2,282	2.42%
1992	2,380	4.29%
1993	2,430	2.10%
1994	2,486	2.30%
1995	2,528	1.69%
1996	2,561	1.31%
1997	2,587	1.02%
1998	2,607	0.77%
1999	2,836	8.78%
2000	3,015	6.31%
2001	3,156	4.68%
2002	3,163	0.22%
2003	3,191	0.89%
2004	3,303	3.51%
2005	3,484	5.48%
2006	3,751	7.66%
2007	4,002	6.69%
2008	4,132	3.25%
2009	4,276	3.49%

Sources: Colorado Department of Local Affairs, 2010; Harvey Economics, 2010.

Exhibit B-2.
City of Dacono Taps, 1991 to 2009

Year	Residential Taps	Commercial Taps	Total Taps	Annual Growth
1991	NA	NA	982	NA
1992	NA	NA	982	0.0%
1993	NA	NA	982	0.0%
1994	NA	NA	982	0.0%
1995	NA	NA	984	0.2%
1996	NA	NA	994	1.0%
1997	NA	NA	998	0.4%
1998	NA	NA	1,013	1.5%
1999	NA	NA	1,083	6.9%
2000	1,104	33	1,137	5.0%
2001	1,126	34	1,160	2.0%
2002	1,145	37	1,182	1.9%
2003	1,190	38	1,228	3.9%
2004	1,248	39	1,287	4.8%
2005	1,336	48	1,384	7.5%
2006	1,408	52	1,460	5.5%
2007	1,449	54	1,503	2.9%
2008	1,459	59	1,518	1.0%
2009	1,472	63	1,535	1.1%

Sources: City of Dacono, 2010; HE 2010.
Note: Breakdown of taps by customer type is not available before 2000.

Between 1991 and 2009, the total number of taps increased by 553, or 56 percent. There was no growth in total taps between 1991 and 1994. Between 1995 and 2009, average annual tap growth was 3.2 percent, or 42 taps per year.

Potable water demands. Historical potable water deliveries from CWCWD through the master meter from 1991 through 2009 are provided in Exhibit B-3. Total deliveries increased by 47 percent between 1991 and 2009. Deliveries decreased in 2002 and 2003, during which time there was a drought, and increased again in 2004 and 2005. By 2005, Dacono's water use reverted to pre-drought levels.

Exhibit B-3.
Potable Water Deliveries to the City of Dacono, 1991 to 2009.

Year	Total Deliveries (MG)
1991	104
1992	118
1993	109
1994	128
1995	118
1996	127
1997	120
1998	123
1999	122
2000	144
2001	143
2002	141
2003	113
2004	126
2005	136
2006	152
2007	156
2008	164
2009	152

Sources: City of Dacono, 2009; HE, 2009.
Notes: (1) Total deliveries reflect the total water delivered from CWCWD to Dacono's master meter.

Exhibit B-4 presents total gallons per capita per day (gpcd) and total gallons per tap per day (gptd) for 1991 through 2009, based on the amount of water delivered through the CWCWD master meter. Total water use per capita and per tap averaged 119 and 309 gallons, respectively, between 1991 and 2009.

The relatively low water use numbers (compared to Frederick, Firestone, and other towns in the area) reflect some specific characteristics of Dacono. The majority of current residents are retirees on fixed incomes and low income seasonal workers; these groups tend to use less water than other groups of people. Additionally, a high percentage of Dacono residents currently live on small lots and do not use much water for outside irrigation. According to the 2000 Census, almost half of the housing units in Dacono were mobile home units. Historically, single family homes have also been located on small lots.

Both the gpcd and gptd are significantly lower for the 2000 to 2009 period, compared to the 1991 to 1999 period. Dacono staff believes that the ten year average of 111 gpcd is a better indicator of future water use and that Dacono will not go back to the water use levels of the '90s.[1]

Exhibit B-4.
City of Dacono Potable Gallons per Capita per Day and Gallons per Tap per Day, 1991 to 2009

Year	Total Water Use Per Capita (gpcd)	Total Water Use Per Tap (gptd)
1991	124	289
1992	136	329
1993	122	303
1994	141	357
1995	128	328
1996	136	351
1997	128	331
1998	129	332
1999	117	307
2000	131	347
2001	124	338
2002	122	327
2003	97	252
2004	104	267
2005	107	268
2006	111	285
2007	107	285
2008	108	295
2009	98	272

Source: Calculations are based on information found in Exhibits B-1, B-2 and B-3.
Note: These numbers are based on the delivery of water through the CWCWD master meter.

Non-potable water demands. The City of Dacono does not separately serve non-potable water demands as of 2009.

Total water requirements. Exhibit B-5 provides the total water requirements for the City of Dacono from 1991 through 2009. The City of Dacono owns and operates its own water distribution system, using treated water from the CWCWD. Dacono does not have an estimate for its own distribution system losses, but believes that they are not significant[2].

Because of the uncertainty of Dacono's exact distribution loss, water requirement numbers provided below reflect the total delivery of treated water through the CWCWD master meter. Total requirements ranged from 318 AF in 1991 to a peak of 442 AF in 2000.

[1] Telephone call with Bill Efting, Administrator, City of Dacono, April, 2010.
[2] City of Dacono response to NISP Questionnaire from Northern Colorado Water Conservancy District, March, 2010.

Exhibit B-5.
Water Requirements for the City of Dacono, 1991 to 2009

Year	Total Deliveries (MG)	Total Requirements (AF)
1991	104	318
1992	118	362
1993	109	333
1994	128	392
1995	118	361
1996	127	391
1997	120	370
1998	123	376
1999	122	373
2000	144	442
2001	143	439
2002	141	433
2003	113	347
2004	126	385
2005	136	416
2006	152	466
2007	156	479
2008	164	502
2009	152	468

Sources: City of Dacono. 2010; Harvey Economics, 2010.
Note: Total deliveries from CWCWD and total requirements are equal.

Projected Water Requirements

The City of Dacono has put significant effort into planning its future growth and expansion[3]. Dacono is currently encouraging growth and anticipates significant growth in the future due to the passing of a regional transit initiative (FasTracks), the expansion of the Denver metro area and growth and development restrictions in other communities in the region. The City has invested in improvements and upgrades to its water distribution system and CWCWD has also invested in additional water infrastructure in the Dacono area to prepare for future growth.

City of Dacono Growth Projections. Dacono has received development plans for about 8,500 additional homes within the city limits. These homes are in various stages of planning, ranging from homes currently under construction, to land areas pending annexation[4]. The City Comprehensive Plan assumes 2.5 people per dwelling unit, for a total of 21,250 additional Dacono residents on top of the estimated 2005 population of 3,500. The 2.5 persons per household estimate reflects the belief on the part of Dacono planners that household density levels in the newer developments will decrease from current levels[5]. In addition to residents within City limits, the Comprehensive Land Use Plan identifies land uses within the 22 square mile planning area. According to the land uses in the Comprehensive plan, Dacono could see an additional 12,855 dwelling units, or 32,137

[3] Winston Associates, *City of Dacono Comprehensive Land Use Plan*, January, 2005.

people, in the service area in the future. Dacono has estimated a potential build out population of 56,600.

Study Team Analysis. To arrive at projections of total water demands between now and 2060 for the City of Dacono, the study team utilized the City's past average annual growth rate of 3.5 percent per year. Exhibit B-6 provides the study team's revised population projections from 2010 through 2060. The population is significantly lower than Dacono's 2005 Development Summary.

Exhibit B-6.
Population Projections for the City of Dacono, 2010 to 2060.

Year	Population
2010	4,400
2015	5,300
2020	6,200
2025	7,400
2030	8,800
2035	10,400
2040	12,400
2045	14,700
2050	17,500
2055	20,700
2060	24,600

Source: Harvey Economics, 2010.

To project potable water demands at the master meter, the study team applied the average total gpcd from 2000 through 2009 of 111 gallons to the current residents and the forecasted additional Dacono population.

As Dacono grows, the average water use per person has been declining. The 2000 to 2009 gpcd average of 111 is fully 18 gallons lower than the 1990 to 1999 average of 129 gpcd. As mentioned previously, the City of Dacono believes that the 111 gpcd is representative of the water use for future growth. Exhibit B-7 provides the projected water demands for Dacono from 2010 to 2060. As the Dacono system losses are unknown, HE has assumed a 5 percent loss for future projections. Over that period water demands are projected to increase from 580 AF in 2010 to 3,220 AF by 2060, an increase of 2,640 AF. Water requirements are expected to increase by 455 percent, or at an annual average rate of 3.5 percent.

[4] *City of Dacono Development Summary*, 2005.
[5] The 2000 U.S. Census reports 2.77 persons per household for Dacono.

Exhibit B-7.
Water Demand Projections for the City of Dacono, 2010 to 2060

Year	Water Deliveries (MG)	Water Deliveries (AF)	Water Requirements (AF)
2010	180	550	580
2015	210	650	690
2020	250	770	820
2025	300	920	970
2030	360	1,090	1,150
2035	420	1,300	1,360
2040	500	1,540	1,620
2045	600	1,830	1,920
2050	710	2,170	2,280
2055	840	2,570	2,710
2060	1,000	3,060	3,220

Source: Harvey Economics, 2010.

Conservation[6]

The City of Dacono encourages water conservation through a variety of measures. Residential and commercial customers are fully metered. Most city parks and other public facilities have metering in place as of late 2005 and monitoring started in 2006. The City bills its customers monthly and changed its billing system from a decreasing block rate structure to an increasing block rate structure in 2003. Additional conservation measures include the following educational, regulatory, operational and incentive measures:

- The City regularly sends out newsletters and special mailings to its residents. Many of these communications contain information on watering restrictions and conservation techniques and direct residents to websites concerning efficient water use and conservation.
- Dacono enacts watering restrictions every summer. These restrictions are passed by resolution and limit outside watering to specific days and times.
- The City actively maintains its distribution facilities by flushing, maintaining fire hydrants, valve exercising, testing backflow devices and using flow testing water meters.
- The City uses a demand-based formula for calculating the amount of water to be dedicated in each subdivision development. The model takes into account lot size, type of irrigation, type of landscaping, use of water conserving devices (shower heads, faucets, dual flush toilets, etc.), and a variety of other factors. Any conservation measures that are incorporated into the development will result in less water dedication from the developer. The City analyzes water use in developments one year after

[6] Thompson, Tracie, Karen Cumbo and Jon Rabas, 2005. *City of Dacono Comprehensive Land Use Plan, 2005; City of Dacono Water Fees and Charges Ordinance No. 618; City of Dacono Water Restriction Resolutions, 2002 through 2005*.

construction to make sure consumption is in line with the demand model and readjusts if necessary.

- Dacono city managers believe that significant water reduction will come through landscaping practices conducive to an arid climate, such as using "secondary" water (less than fully treated water) for irrigation, limiting the size of irrigated lawns and increasing the use of low-water (xeric) landscape materials. The City encourages the use of all of these measures.

Future Conservation Plans

The Comprehensive Plan describes the creation of a new City Center. As part of this plan the city will adopt water conservation measures for public facilities, including adopting xeriscape landscaping principles and reducing the use turf grass; installation of water-saving plumbing; use of secondary water for major irrigated areas; and use of irrigation control systems that respond to weather and reduce water runoff. In 2010, Dacono received funds from CWCB to develop a water conservation plan. The goal of the plan is to reduce the total per capita water use by 10 percent over a ten-year planning period.

APPENDIX C
TOWN OF EATON
Water Demands

The Town of Eaton provides potable and non-potable water to residential and non-residential customers in an area that includes the "old" part of town, four subdivisions (Hawkstone[1], Eaton Commons, Maplewood, and Governors Ranch), and approximately 640 acres of parks and open space. Eaton does not currently provide service to any large water users.[2]

The Town of Eaton receives potable water from the North Weld County Water District (NWCWD). This water is owned by the Town and is treated by NWCWD.[3] To account for diversion and treatment plant losses, Eaton is responsible for providing water rights for 110 percent of deliveries made to its master meter. Because Eaton is the responsible party charged with securing supplies to meet current and future demands, treated water deliveries made by the NWCWD to Eaton were included as part of Eaton's demand evaluation.

Historical Water Demands

In terms of both the number of housing units and population, Eaton has grown substantially in recent years. Exhibit C-1 reports population, housing and water tap totals for the Town of Eaton for the period 1990 to 2009, including annual growth rates for each.

[1] The Town is not responsible for demands associated with the Hawkstone Park, which uses ditch shares for irrigation. These figures are not included in Eaton's totals.
[2] Donald Cadwallader and Gary Carsten, Town of Eaton interview, September 2004.
[3] Town of Eaton Web Page, http://www.eatonco.org, accessed October 2004.

Exhibit C-1.
Population, Housing Units and Water Tap Changes for the Town of Eaton, 1990 to 2009

Year	Population	Annual Percent Change	Housing Units	Annual Percent Change	Taps Total	Annual Percent Change
1990	1,959	N.A.	789	N.A.	N.A.	N.A.
1991	1,996	1.9%	798	1.1%	N.A.	N.A.
1992	2,060	3.2%	801	0.4%	N.A.	N.A.
1993	2,111	2.5%	823	2.7%	N.A.	N.A.
1994	2,196	4.0%	868	5.5%	N.A.	N.A.
1995	2,328	6.0%	894	3.0%	N.A.	N.A.
1996	2,457	5.5%	935	4.6%	N.A.	N.A.
1997	2,535	3.2%	960	2.7%	N.A.	N.A.
1998	2,559	0.9%	980	2.1%	1,182	N.A.
1999	2,632	2.9%	1,020	4.1%	1,189	0.6%
2000	2,690	2.2%	1,108	8.6%	1,300	9.3%
2001	2,944	9.4%	1,330	20.0%	1,350	3.8%
2002	3,456	17.4%	1,448	8.9%	1,480	9.6%
2003	3,702	7.1%	1,510	4.3%	1,543	4.3%
2004	3,818	3.1%	1,521	0.7%	1,551	0.5%
2005	3,974	4.1%	1,583	4.1%	1,610	3.8%
2006	4,113	3.5%	1,639	3.5%	1,699	5.5%
2007	4,225	2.7%	1,683	2.7%	1,748	2.9%
2008	4,295	1.7%	1,711	1.7%	1,762	0.8%
2009	4,335	0.9%	1,727	0.9%	1,772	0.6%

Source: Colorado Department of Local Affairs, http:dola.colorado.gov/, accessed May 2010; Town Eaton document, "Town of Eaton-Historical Populations and Housing," obtained September 2004.

From 1990 through 2009, the average annual growth rate for population was 4.3 percent and for housing units was 4.2 percent.

Between 2000 and 2003, Eaton's population grew by approximately 38 percent or at an average annual rate of 11 percent. It is worth noting that this period immediately followed Eaton's annexation of the four subdivisions listed above.[4] Analysis of the historic record suggests that growth during this period, in absolute percentage terms, exceeds that of any other period in recent history. Since 2003, the population growth rate has slowed substantially with an average annual growth of less than 3 percent.

It should be noted that water tap changes do not correspond to housing units since taps include a small number of commercial users and since taps are sold before housing units are occupied. Eaton currently provides potable service to approximately 1,770 taps, including roughly 106 commercial users.

Potable water demands. Exhibit C-2 provides total potable water deliveries for the Town of Eaton from 1990 through 2009.

[4] Donald Cadwallader and Gary Carsten, Town of Eaton interview, September 2004.

Exhibit C-2.
Town of Eaton Potable Water Deliveries,
in Millions of Gallons, 1990 to 2009

Year	Deliveries	
	Total	Percent Change
1990	118	N.A.
1991	123	4.4%
1992	127	2.8%
1993	117	-7.9%
1994	133	14.0%
1995	123	-7.8%
1996	137	11.8%
1997	135	-1.4%
1998	162	20.1%
1999	151	-7.1%
2000	175	16.0%
2001	186	6.5%
2002	202	8.4%
2003	182	-9.9%
2004	187	2.6%
2005	213	14.2%
2006	235	10.4%
2007	215	-8.6%
2008	209	-2.8%
2009	183	-12.5%

Source: Town of Eaton document, "Water Usage: Town of Eaton," obtained September 2004; The Engineering Company files, "EatonPopProj TEC.xls," obtained October 2004; Town of Eaton, 2010.

Between 1990 and 2009, total potable water use increased by 55 percent, or at an average annual rate of 2.3 percent. However, 2009 was a wet year and water use dropped significantly. From 1990 to 2006, total water use increased by 99 percent, or at an average annual rate of 4.4 percent.

The impact of the 2009 wet conditions is also evident in the total gallons per capita and per tap per day totals presented in Exhibit C-3.

Exhibit C-3.
Gallons per Capita and per Tap per Day for the Town of Eaton, 1990 to 2009

Year	Gallons per Capita per Day	Gallons per Tap per Day
1990	165	407
1991	169	417
1992	169	416
1993	152	374
1994	166	409
1995	144	356
1996	153	377
1997	146	360
1998	174	401
1999	157	370
2000	178	412
2001	173	420
2002	160	553
2003	135	323
2004	134	330
2005	147	363
2006	157	379
2007	139	337
2008	133	325
2009	116	283

Source: Figures are based on the data presented in Exhibits C-1 and C-2.

Eaton's average gpcd and gptd from 1990 to 2009 was 153 and 381, respectively.

Non-potable water demands. Non-potable supplies are used to irrigate parks and open spaces as well as subdivisions that utilize dual use systems. Eaton did not meter non-potable deliveries prior to 2004; however, the study team was able to obtain estimates of historical use by comparing the deliveries of residential users with dual-use systems to those without. Eaton's non-potable water supply increased dramatically from 2003 to 2004 due to the addition of two large parks and two subdivisions with dual water systems[5]

Total Water Requirements. Exhibit C-4 presents total water requirements for the Town of Eaton for the period 1990 to 2009. Total water requirements increased by 55 percent from 1990 through 2009.

[5] Gary Carsten, Town of Eaton, 2010.

Exhibit C-4.
Total Water Deliveries and Requirements for the Town of Eaton, 1990 to 2009, in Millions of Gallons and Acre-Feet

	Potable Water Deliveries		Non-Potable Water Deliveries		Total Deliveries	Total Water Requirements
Year	MG	AF	MG	AF	AF	AF
1990	118	363	N.A.	N.A.	363	447
1991	123	378	N.A.	N.A.	378	466
1992	127	389	N.A.	N.A.	389	480
1993	117	358	N.A.	N.A.	358	442
1994	133	409	N.A.	N.A.	409	504
1995	123	377	N.A.	N.A.	377	464
1996	137	421	N.A.	N.A.	421	519
1997	135	415	N.A.	N.A.	415	512
1998	162	498	N.A.	N.A.	498	614
1999	151	463	1	3	466	574
2000	175	537	2	6	543	668
2001	186	572	3	8	580	714
2002	202	620	4	11	631	775
2003	182	558	5	14	572	702
2004	187	573	104	319	892	1,025
2005	213	654	106	325	979	1,131
2006	235	722	113	347	1068	1,236
2007	215	660	113	347	1007	1,160
2008	209	642	112	344	985	1,135
2009	183	561	88	270	831	962

Source: Town of Eaton documents, "Water Usage: Town of Eaton" and "Subdivision Water Usage," obtained September 2004, "2010 Water Conservation Planning Grant", obtained May, 2010; Harvey Economics, 2010.
Note: Eaton's non-potable water did increase from 5MG to 104MG in one year. In 2004, Eaton added two large parks and two dual water system subdivisions.[6]

Total water requirements reflect a 10 percent charge by NWCWD on top of losses associated with distribution between the master meter and end user. Non-potable deliveries were adjusted to account for delivery losses, since these supplies are delivered via a combination of well and irrigation ditches.

Projected Water Requirements

Potable demands. The Town of Eaton provided the study team with potable water demand projections through 2030.[7] The Town based these forecasts on tap projections prepared by TEC and published in Eaton's *Water System Master Plan*. In its report, TEC forecasted tap growth based on annual increases of 120 ("probable") and 240 ("worst case") taps per year. TEC estimated 10,750 total water taps at buildout.

Exhibit C-5 provides the projected tap and population growth for Eaton. The number of taps is projected to grow at an average annual rate of 3.75 percent per year until 2060. This is the historical average annual growth from 1998 to 2009. This period reflects the slowing growth rate experienced by Eaton.

[6] Gary Carsten, Town of Eaton, 2010.
[7] Town of Eaton Document, "Projected Usage: Town of Eaton", obtained October 2004.

Exhibit C-5.
Projected Tap and Population Growth for the Town of Eaton, 2010 to 2050

Year	Number of Taps	Population
2010	1,838	4,455
2015	2,210	5,355
2020	2,657	6,437
2025	3,193	7,738
2030	3,839	9,302
2035	4,614	11,181
2040	5,547	13,441
2045	6,667	16,157
2050	8,015	19,421
2055	9,634	23,346
2060	11,581	28,063

Source: Harvey Economics, 2010.

Non-potable demands. Non-potable demands are assumed to grow at around 3 million gallons per year[8]. This will cover any expansion to parks or green space and the new dual-use water system subdivisions.

Study team demand projections. Exhibit C-6 provides potable, non-potable and total water requirements through 2060. Total water requirements reflect adjustments made to potable demands to account for 19 percent system losses (10 percent charged by NWCWD compounded with 8 percent local distribution losses) experienced by Eaton. Non-potable demands would experience a 10 percent loss, assuming these are piped from the wells and not in open ditches.

[8] Town of Eaton response to NISP Questionnaire from Northern Colorado Water Conservancy District, March 2010.

Exhibit C-6.
Water Demand Projections for the Town of Eaton, 2010 to 2060.

Year	Potable (MG)	Non-Potable (MG)	Total (MG)	Total (AF)	Total Water Requirements (AF)
2010	190	110	290	900	1,100
2015	200	120	320	1,000	1,200
2020	220	140	360	1,100	1,300
2025	250	150	400	1,200	1,400
2030	270	170	440	1,400	1,600
2035	310	180	490	1,500	1,800
2040	350	200	550	1,700	2,000
2045	400	210	610	1,900	2,200
2050	460	230	690	2,100	2,500
2055	530	240	770	2,400	2,800
2060	620	260	870	2,700	3,200

Source: Town of Eaton document, "Water Usage: Town of Eaton," obtained September 2004; Harvey Economics, 2010.

Conservation

The Town of Eaton has implemented several measures to promote conservation throughout its system. Treated water supplies are priced according to an increasing block rate structure.[9] In addition, Eaton now requires all new developments to utilize dual-use irrigation systems and is considering converting older residential areas, as well.[10] The Town also provides conservation information to its customers via its web site and handouts. In March of 2010, the Town of Eaton applied for a grant to develop a water conservation plan. This plan will make Eaton eligible for financial assistance from the CWCB and CWRPDA, as well as providing the town with steps to take to conserve more water.

[9] Town of Eaton Web Page, http://www.eatonco.org, accessed October 2004.
[10] Donald Cadwallader and Gary Carsten, Town of Eaton Interview, September 2004.

APPENDIX D
TOWN OF ERIE
Water Demands

The Town of Erie is located in Boulder County, Colorado, just north of the City of Lafayette. Erie is a small but rapidly growing community on the northern edge of the Denver metropolitan area. Incorporated in 1874, this historic coal mining community provided coal to residents and businesses in the region and the steam locomotives that passed through northern Colorado.

Prior to 1995, the Town of Erie was small and rural in nature; considerable growth occurred after 1997, continuing through 2006. Erie serves primarily as a bedroom community for the Denver metropolitan area as of 2010. Encompassing about 14 square miles, the Town of Erie and its water department serves most of the water consumers within its service area. Left Hand Water District temporarily serves a very small portion of Erie's service area.[1] No large industrial or other water users were evident as of 2010.

Historical Water Demands

The Town of Erie population has grown from about 1,260 persons in 1990 to 6,300 persons by the year 2000; 2010 is estimated at 18,000 persons. Population growth and the change in the number of housing units since 1980 are depicted in Exhibit D-1.

Exhibit D-1.
Population and Housing Unit Change for the Town of Erie, 1980 to 2009

Year	Number of Persons	Annual Percent Change	Number of Housing Units	Annual Percent Change
1980	1,254	N.A.	440	N.A.
1990	1,258	>0.1%	460	>0.1%
2000	6,291	17.5%	2,282	17.4%
2001 *	7,580	20.5%	2,748	20.4%
2002 *	8,190	8.0%	2,968	8.0%
2003 *	8,930	9.0%	3,236	9.0%
2004	10,390	16.3%	4,257	31.6%
2005	14,043	35.2%	5,201	22.2%
2006	15,587	11.0%	5,773	11.0%
2007	15,910	2.1%	5,893	2.1%
2008	17,382	9.3%	6,230	5.7%
2009	17,995	3.5%	6,450	3.5%

* Beginning of the year estimates.
Sources: U.S. Bureau of Census; DRCOG, Metro Vision Resource Center, 2004; Clarion Associates, *Erie Comprehensive Plan Update Draft*, August 2004; City of Erie, 2010.

[1] Interview with Gary Behlen, Town of Erie Public Works Director, conducted by Ed Harvey. June 2004.

From 1990 to 2010, Erie's population and number of housing units have grown by the extraordinary annual rate of 15.0 percent and 14.9 percent, respectively. This rapid growth continued to 2006, slowed in 2007, returned in 2008 and slowed again in 2009.

Potable water demands. The Town of Erie's water demands also show considerable growth since the mid-1990s. Exhibit D-2 provides a breakdown of residential and non-residential water deliveries to end users in the Town of Erie from 1995 to 2009.

Exhibit D-2.
Town of Erie Potable Water Deliveries, 1995 to 2009

Year	Water Deliveries to End Users (MG)			Percent Change	Total Number of Water Taps**
	Residential	Non-Residential*	Total		
1995	N.A.	N.A.	65	N.A.	647
1996	N.A.	N.A.	74	14%	737
1997	70	5	75	1%	904
1998	153	18	170	128%	1,243
1999	N.A.	N.A.	251	47%	2,104
2000	346	30	376	50%	2,248
2001	427	37	464	23%	2,900
2002	416	132	548	18%	3,157
2003	394	86	480	-12%	3,409
2004	569	81	650	35%	4,257
2005	718	102	821	26%	5,201
2006	811	115	926	13%	5,773
2007	799	114	913	-1%	5,893
2008	824	117	941	3%	6,230
2009	757	108	865	-8%	6,450

* Non-residential includes water hydrants.
** Number of taps at the beginning of the year.
Source: Tetra Tech, *Erie Water Master Plan, 2004*; and Town of Erie, 2010.

From 1997 through 2009, total water deliveries for the Town of Erie increased almost 10 times. Water deliveries declined by about 10 percent from 2008 to 2009 owing to a wet year. In 2002, residential water use comprised 76 percent of total water sales, and residential use has averaged 88 percent of total water sales from 1997 through 2009. Commercial water sales were rather modest in the late 1990s but have grown considerably since 2001. In the last few years, commercial water sales accounted for almost 12 percent of total water sales.

Exhibit D-3 provides Erie's gallons per capita and per tap per day from 1995 through 2009.

Exhibit D-3.
Gallons per Capita and per Tap per Day for the Town of Erie, 1995 to 2009

Year	Gallons per Capita per Day		Gallons per Tap Per Day
	Total	Residential	
1995	105	N.A.	275
1996	98	N.A.	275
1997	105	98	227
1998	104	93	376
1999	125	N.A.	327
2000	164	151	458
2001	168	154	438
2002	183	139	476
2003	147	121	386
2004	171	150	418
2005	160	140	432
2006	163	143	439
2007	157	138	424
2008	148	130	414
2009	132	115	367

Note: Figures are based on population and taps at the beginning of each year.
Source: Tetra Tech, *Erie Water Master Plan, 2004;* and Information from Exhibits D-1 and D-2.

Gallons per capita per day (gpcd) averaged 142 and 131 for total and residential water use, respectively, from 1995 through 2009. Gallons per tap per day (gptd) averaged 382 during this period. Annual fluctuations are likely attributable to weather, with some upward trend in these data as new, larger lot houses have been built in recent years.

Non-potable demands. Erie's non-potable demands include watering the green space for parks, ball fields and a golf course, although the golf course utilizes some of its own water for irrigation.[2] Erie estimates its non-potable water requirements at 2.5 acre-feet per acre for water intensive irrigation and 1.33 acre-feet per acre for native irrigation.[3] The Town of Erie initiated non-potable water use in 2001 and averaged about 80 acre-feet of deliveries between 2001 and 2003. Non-potable demand increased by more than four times in 2004 and has averaged over 280 AF since then. Non-potable water demands are met from raw water deliveries and the reuse capability of the Town's Windy Gap units, which it owns and leases, as of 2010.

Total water requirements. The Town of Erie's total water requirements are the sum of potable water deliveries, non-potable water deliveries and an accounting for system losses of 13 percent. Exhibit D-4 offers a summary of total water requirements for the Town of Erie through 2009.

[2] Interview with Gary Behlen, Town of Erie Public Works Director, and Paul Zilis, attorney, conducted by Ed Harvey, June 2004.
[3] Ibid.

Exhibit D-4.
Total Water Requirements for the Town of Erie, 1995 through 2009

Year	Potable Water Deliveries MG	Potable Water Deliveries AF	Non-Potable Water Deliveries AF	Total Deliveries to Erie Customers (AF)	Total Erie Water Requirements (AF)
1995	65	199	0	199	229
1996	74	227	0	227	261
1997	75	229	0	229	264
1998	170	523	0	523	601
1999	251	770	0	770	885
2000	376	1,154	0	1,154	1,327
2001	464	1,424	80	1,504	1,729
2002	548	1,682	80	1,762	2,025
2003	480	1,474	80	1,554	1,786
2004	650	1,995	360	2,355	2,707
2005	821	2,518	227	2,745	3,155
2006	926	2,842	387	3,229	3,711
2007	913	2,802	153	2,955	3,397
2008	941	2,888	381	3,270	3,758
2009	865	2,654	192	2,845	3,270

Source: Town of Erie Accounting Office, October 2004; Tetra Tech, *Erie Water Master Plan, 2004*; Town of Erie Public Works Department, September 2004; Town of Erie, 2010.

Total water requirements for the Town of Erie increased from 230 acre-feet in 1995 to 3,270 acre-feet in 2009, an increase of 3,040 acre-feet over that period.

Projected water requirements

CDM's water demand projections. CDM's water demand projections for the Town of Erie are found in the 2008 *Erie Water Conservation Plan*.[4] CDM developed these projections by applying population projections to an assumed raw water demand in gallons per capita per day. These projections are summarized in Exhibit D-5.

[4] CDM, *Erie Water Conservation Plan*, July 2008.

Exhibit D-5.
CDM Water Demand Projections for the Town of Erie, 2005 to 2025

Year	Projected Demands (AFY)	Year	Projected Demands (AFY)
2007	4,040	2017	6,340
2008	4,290	2018	6,590
2009	4,540	2019	6,860
2010	4,820	2020	7,130
2011	5,010	2021	7,420
2012	5,210	2022	7,710
2013	5,420	2023	8,020
2014	5,640	2024	8,340
2015	5,860	2025	8,680
2016	6,100		

Source: CDM, *Erie Water Conservation Plan*, July 2008.

The above water demand projections assume a growth rate of 6 percent through 2010 and 4 percent thereafter. They also assume a gpcd of 230.

The methodology employed by CDM was appropriate, given the level of information available in the year 2008. A calculation of population multiplied by gallons per capita per day to develop water demand projections is a commonly used technique.

Study team water demand projections. The Town of Erie has undergone some changes since the year 2008, and information available in 2010 offers an opportunity to both update and refine water demand projections prepared by CDM. The maximum population in the comprehensive plan is estimated to occur in the year 2025, with a population of about 40,700 in 14,600 housing units. However, due to the recent slowdown, HE projects that Erie will not reach 40,700 people until 2030.

The Town of Erie 2005 Comprehensive Plan assumes that all growth in Erie will stop once the town reaches 40,700 people. However, commercial growth will continue to occur, in-fill will continue to occur, and Erie has plenty of space to expand. HE has projected the population of Erie beyond 2030, to 2060, because there is no developable land subject to permanent physical restriction and it is possible for Erie to continue growth beyond 40,700 people. It is noted Erie must make land use decisions through an update to its Comprehensive Plan and other means as it approaches that population.

Exhibit D-6.
Housing Unit and Population Projections for the Town of Erie, 2010 to 2060

Year	Number of Housing Units	Population	Average Annual Growth Rate
2010	6,837	19,075	N.A.
2015	8,318	23,207	4.00%
2020	10,120	28,235	4.00%
2025	12,313	34,352	4.00%
2030	14,980	41,795	4.00%
2035	16,539	46,145	2.00%
2040	18,261	50,948	2.00%
2045	20,162	56,251	2.00%
2050	22,260	62,105	2.00%
2055	24,577	68,569	2.00%
2060	27,135	75,706	2.00%

Source: Clarion Associates, *Draft Erie Master Plan Update*, August 2004; Harvey Economics, 2010.

The growth rates suggested in the Erie Master Plan Update are extraordinary, but in keeping with past experience. In preparing this update, Clarion Associates thoroughly considered growth influences including development plans, available land and Town policies. Growth rates are assumed to decline as the population gets larger. This evaluation of Erie's growth prospects, coupled with extraordinary historical growth that the Town has experienced, suggests that these projections are reasonable.

The study team revised water demand projections for the Town of Erie based upon information available in the spring of 2010. Potable water demands were projected based upon the average gpcd for the years 2000 to 2009, multiplied by population projections as indicated in Exhibit D-6. Non-potable water was forecast by the Town of Erie to be about 7,000 AF at a 40,700 population. After that point non-potable water is assumed to remain constant. Total Erie water requirements assume a 13 percent total loss, including losses from the point of diversion to the tap. Exhibit D-7 presents these demand projections for the Town of Erie.

Exhibit D-7.
Revised Water Demand Projections for the Town of Erie, in Acre-Feet, 2010 to 2060

Year	Potable Water Demand	Non-Potable Water Demand	Total Deliveries to Erie Customers	Total Erie Water Requirements
2010	3,400	500	3,900	4,500
2015	4,100	2,100	6,200	7,100
2020	5,000	3,700	8,700	10,000
2025	6,100	5,400	11,500	13,200
2030	7,500	7,000	14,500	16,700
2035	8,200	7,000	15,200	17,500
2040	9,100	7,000	16,100	18,500
2045	10,000	7,000	17,000	19,500
2050	11,100	7,000	18,100	20,800
2055	12,200	7,000	19,200	22,100
2060	13,500	7,000	20,500	23,600

Source: Harvey Economics, 2010.

Based upon these assumptions, total Erie water requirements would increase from 4,500 acre-feet in the year 2010 to 23,600 acre-feet in the year 2060. This represents a 424 percent change over that period of time.

Conservation

The Town of Erie has updated its Water Conservation Master Plan in 2008. The conservation goals are: to achieve an average annual gpcd of 190, including use of non-potable water; 690 AF per year of reclaimed water use; and reduce water use by 15 percent on all existing city parks and landscaping, all by 2014. To meet these goals, Erie is planning to implement conservation measures that are compatible with the community and establish a monitoring system to measure the success of conservation programs on an annual basis.

To meet these goals, Erie has implemented or is expanding a number of conservation measures to reduce water use. Erie has undertaken a public education effort to apprise its customers about efficient water use practices and offers conservation tips on its website and links to other conservation sites. The Town distributes a water conservation flyer, and it has sponsored a six-part series on water conservation on local television.

Erie actively promotes water conservation through requirements for native seeding and xeriscaping in open space and for new parks.

The Town of Erie has an inclining block rate structure. The Public Works Department continually monitors for leaks in water lines and sprinklers, making the necessary repairs.

Erie participates in the irrigation audit program, conducted by the Center for ReSource Conservation. This program tests irrigation systems for efficiency and makes recommendations for improvements.

APPENDIX E
CITY OF EVANS
Water Demands

The City of Evans is located in south-central Weld County just south of the City of Greeley. The City's long-term growth boundary encompasses a total area of about 17,849 acres (27.9 square miles) and includes an incorporated area of 5,930 acres and an unincorporated area of about 11,919 acres.

The City of Evans is responsible for providing water to the residential, commercial, industrial and public users located within its service area. Approximately 95 percent of Evans' customers are residential. There are currently no large water users served by the City. While the City of Greeley distributes potable water to Evans' customers, Evans is responsible for securing the raw water necessary to meet those demands.[1]

Evans currently serves about 20,000 residents within the city. The City is also responsible for providing water to the around 2,400 residents within the Arrowhead and Hill-N-Park subdivisions.[2]

Between 2000 and 2002, the City of Evans ranked among the fastest growing cities in Colorado. Exhibit E-1 provides population estimates for the City for the period 1990 to 2009. Over this period, the City grew at an average annual rate of 6.7 percent. By comparison, the average annual rate of growth for the city between 1960 and 2000 was 4.8 percent.

[1] City of Evans, *City of Evans 2009 Water Conservation Plan*, obtained May 2010.
[2] Tetra Tech RMC, *City of Evans Water Demand Projections*, September 2003, Pg. 2.

Exhibit E-1.
City of Evans Population, 1990 to 2009

Year	Total	Annual Change
1990	5,876	N.A.
1991	6,018	2.4%
1992	6,250	3.9%
1993	6,516	4.3%
1994	6,880	5.6%
1995	7,178	4.3%
1996	7,538	5.0%
1997	8,048	6.8%
1998	8,313	3.3%
1999	8,988	8.1%
2000	9,514	5.9%
2001	11,534	21.2%
2002	13,282	15.2%
2003	15,040	13.2%
2004	16,251	8.1%
2005	17,518	7.8%
2006	17,493	-0.1%
2007	17,971	2.7%
2008	18,764	4.4%
2009	20,014	6.7%

Note: These figures do not reflect customers within Arrowhead and Hill-N-Park subdivision.
Source: City of Evans, *City of Evans Comprehensive Plan:* 2002, May 2002, Pg. B-1; DOLA, 2010.

Historical water demands

Potable use. Exhibit E-2 provides residential, non-residential and total potable water deliveries to end users in Evans and the two subdivisions, Arrowhead and Hill-N-Park.

Exhibit E-2.
City of Evans Water Use, in Million Gallons, 1990 to 2009

Year	Potable	Non-potable	Total
1990	451	50	501
1991	463	51	514
1992	452	50	502
1993	521	58	579
1994	556	62	618
1995	504	56	560
1996	577	64	642
1997	557	62	619
1998	653	73	726
1999	619	69	688
2000	745	83	828
2001	764	92	855
2002	795	101	896
2003	774	109	883
2004	752	118	870
2005	829	127	956
2006	846	170	1,015
2007	840	164	1,004
2008	833	84	917
2009	735	82	817

Note: Figure represents final sales to end users, excluding any losses.
Non-potable figures exclude water from the Evans Town Ditch.

Source: City of Evans Accounting Records, various years; Tetra Tech RMC*, City of Evans Water Demand Projections Memorandum*, September 8, 2003, and HE estimate of 2003 demand, Harvey Economics, 2010.

Water use within the City of Evans increased by 382 million gallons (MG), or 85 percent, over the period 1990 to 2008, decreasing in 2009, and due somewhat to higher than usual summer rainfall. Historically, potable use has averaged around 90 percent of total water use. From 1990 through 2009, total per capita daily water (gpcd) ranged from approximately 112 to 246 gallons per day, and daily potable per capita water use ranged from 101 to 221 gpcd. Average gpcd over this period was 196 and 175 for total and potable water use, respectively.

Non-potable use. Besides these potable delivery requirements, the City provides non-potable water delivered via the Evans Town Ditch for irrigation on rural properties, city parks, schools and open space.[3] This water has also recently been used to meet residential outdoor demands for two subdivisions which have dual water systems. The introduction of dual use water systems explains, in part, why population has grown at a faster rate than potable water demands.

Total water requirements. Potable and non-potable deliveries to end users do not reflect total raw water demand for the City of Evans without accounting for distribution system losses and additional charges imposed by the City of Greeley, which include

[3] Tetra Tech RMC, "Memorandum re: City of Evans Water Demand Projections," Table 5. September 8, 2003.

treatment losses and losses associated with Greeley's Boyd and the Bellevue systems: 8 percent distribution system loss and a 13.5 percent average shrinkage charge.

Non-potable use will not face the treatment plant loss, but will incur higher conveyance losses since open ditches are used for this purpose. The study team assumes those losses will equal an additional 15 percent on top of 8 percent distribution losses, so that non-potable deliveries face similar shrinkage and distribution losses as potable deliveries. Treatment and conveyance losses are reflected in the charges imposed by Greeley that treats the water for Evans. Including losses, Exhibit E-3 presents historical total water requirements for the City of Evans, which reached a high of 4,000 acre-feet in 2006, an increase over 1990 of 2,000 acre-feet, or 102 percent.

Exhibit E-3.
Total City of Evans Raw Water Requirements, 1990 through 2009

Year	Potable and Non-Potable Water Deliveries (MG)	Potable and Non-Potable Water Deliveries (AF)	Total Water Requirements
1990	500	1,500	2,000
1991	510	1,600	2,000
1992	500	1,500	2,000
1993	580	1,800	2,300
1994	620	1,900	2,400
1995	560	1,700	2,200
1996	640	2,000	2,500
1997	620	1,900	2,500
1998	730	2,200	2,900
1999	690	2,100	2,700
2000	830	2,500	3,300
2001	860	2,600	3,400
2002	900	2,700	3,600
2003	880	2,700	3,500
2004	870	2,700	3,400
2005	960	2,900	3,800
2006	1,020	3,100	4,000
2007	1,000	3,100	4,000
2008	920	2,800	3,600
2009	820	2,500	3,200

Source: City of Evans Accounting Records, various years; Harvey Economics, 2010.

Projected Water Requirements

Tetra Tech RMC 2003 projections. The City of Evans provided the study team with water demand projections for 2008 and 2018. Projected water demands were derived using land use plans developed by the City. Tetra Tech indicates that, as part of its 2002 Comprehensive Plan, the City of Evans developed intermediate and ultimate buildout land use plans for development within their priority growth area. This area was "based on the location of the City's existing and planned infrastructure (i.e., water, sewer, stormwater, etc.), and the City's anticipated ability to efficiently provide services." Tetra Tech utilized future

land use assumptions to determine the maximum number of people that might be accommodated under these plans and projected water demand for 2008 as the intermediate period and for 2018 as ultimate buildout.

Tetra Tech RMC based projected potable and non-potable residential water demand on water use inside and outside the dwellings, assuming lot sizes and irrigation requirements. Dwelling units were related to population through person per household assumptions. Non-residential demands, including commercial and industrial, were also based upon indoor and outdoor use, tied to building square footages. The dwelling unit and building square foot assumptions tied back to the Comprehensive Plan. Finally, Tetra Tech RMC assumed that 80 percent of new irrigation demands would be met by non-potable supplies.

The study team evaluated the methodology utilized by Tetra Tech RMC and found that the methods used to calculate water demands were generally sound, given the availability of data. One exception to this assessment pertains to the approach taken to develop projections of population. Exhibit E-4 provides the short-term growth rates that were applied to current City population estimates to develop the projections used by Tetra Tech RMC. Population beyond the year 2008 was assumed to grow at a constant annual rate of three percent. Exhibit E-4 also includes the resulting annual changes in total population.

Exhibit E-4.
Tetra Tech's City of Evans Population Projections

Year	Short Term Growth Rate	City Population	Arrowhead and Hill-N-Park	Total	Annual Change
2003		14,700	2,394		
2004	8%	15,876	2,394	18,270	1,176
2005	8%	17,146	2,394	19,540	1,270
2006	6%	18,175	2,394	20,569	1,029
2007	5%	19,084	2,394	21,478	909
2008	5%	20,038	2,394	22,432	954

Source: Tetra Tech RMC, Memorandum Re: City of Evans Water Demand Projections, September 8, 2003.

A second modification to the Tetra Tech projections was required. The total land area within Evans' city limits has grown since the development of the 2003 demand projections. This change required the study team to update future land use so that it was consistent with current City totals.

Study team demand projections. The project team projected population forecasts based on an assumed annual rate of growth of three percent between 2010 and 2020 and 2.5 percent, thereafter.[4] This represents a decrease in the *rate* of growth in recent years; however it results in total growth more consistent with recent trends. Furthermore, this growth is consistent with that assumed by the State Demographer for Weld County and slightly less

[4] The growth rates were not applied to the Arrowhead and Hill-N-Park areas because they have already reached buildout. City of Evans Letter, regarding: Evans C-BT Cap Calculation, From E. Smith to M. Conley, Sept. 1998. Attachment III).

than the rate assumed by Greeley for Evans in their 2002 water demand study.[5] Exhibit E-5 provides the project teams' population projections for water demand forecasting purposes.

Exhibit E-5.
Revised Population Projections for the City of Evans

Year	Annual Growth Rate	City Population	Arrowhead and Hill-N-Park	Total	Annual Change
2010	N.A.	20,800	2,400	23,200	N.A.
2015	3.0%	24,100	2,400	26,500	700
2020	3.0%	28,000	2,400	30,400	800
2025	2.5%	31,600	2,400	34,000	700
2030	2.5%	35,800	2,400	38,200	800
2035	1.2%	38,000	2,400	40,400	400
2040	0.0%	38,000	2,400	40,400	0
2045	0.0%	38,000	2,400	40,400	0
2050	0.0%	38,000	2,400	40,400	0
2055	0.0%	38,000	2,400	40,400	0
2060	0.0%	38,000	2,400	40,400	0

Source: Harvey Economics, 2010.

Residential, non-residential and total water demands were derived by applying the revised population projections to updated land use projections in the manner utilized by Tetra Tech RMC. To account for changes since 2002, the City's buildout land use estimates were made consistent with new acreage totals, representing about 1,500 more acres than accounted for in the Tetra Tech RMC study.[6] Exhibit E-6 provides a summary of the land use projections used to determine future demands.

Exhibit E-6.
Revised Land Use Projections for the City of Evans

Residential	Acres	Commercial	Acres
Rural Density	1,112	Local	124
Low Density	850	General	280
Medium Density	232	Industrial	478
Urban Density	1,271	Mixed Use/Employment	261
High Density	205	Parks/Trails/Open Space	1,117
Sub-total	3669		2,261
Total, residential and commercial			**5,930**

Source: Harvey Economics, 2004.

[5] City of Greeley, *City of Greeley Water Demand Study: 2002*, May 2002, Pg. 3-14.
[6] Land development since the 2002 Comprehensive Plan was assumed to occur as described in the Comprehensive Plan. For each development type, the percentage of total acreage, as defined in the Comprehensive Plan, was used to allocate the new acreage.

The total area presented in Exhibit E-6 is capable of accommodating approximately 38,000 people, excluding the two subdivisions outside town. Assuming population growth consistent with Exhibit E-5, the City of Evans will be fully developed by 2033. Residential, non-residential and total water demands were projected for 2033 based on the land use at that time. Population changes between 2002 and 2034 drive the land use absorption which determines water demand by acre. Exhibit E-7 provides residential, non-residential and total water demand through 2060.

Exhibit E-7.
Revised Water Demand Projections for the City of Evans

	Potable Demands (MG)			Non-potable	Total Demands		Raw Water
Year	Residential	Non-residential	Total	Total (MG)	(MG)	(AF)	Requirements (AF)
2010	820	230	1,050	130	1,180	3,600	4,600
2015	1,000	290	1,290	160	1,450	4,400	5,700
2020	1,210	350	1,560	190	1,750	5,400	7,000
2025	1,410	400	1,820	220	2,040	6,300	8,100
2030	1,640	470	2,110	250	2,360	7,200	9,300
2035	1,760	500	2,270	270	2,540	7,800	10,100
2040	1,760	500	2,270	270	2,540	7,800	10,100
2045	1,760	500	2,270	270	2,540	7,800	10,100
2050	1,760	500	2,270	270	2,540	7,800	10,100
2055	1,760	500	2,270	270	2,540	7,800	10,100
2060	1,760	500	2,270	270	2,540	7,800	10,100

Source: Harvey Economics, 2010.

In addition to the end user demands derived from future land use, a 23 percent shrinkage and loss was added to all demands. After considering future suburban house and lot sizes, non-potable use, and disproportionate growth in non-residential demand, the future total water demand is reasonable, compared with historical per capita per day use totals.[7]

Conservation

The City of Evans 2009 Water Conservation Plan (WCP) establishes a goal of reducing water consumption by 13 percent (approximately 6,600 AF) from 2009 to 2018. This goal will be achieved through the use of various water conservation measures and programs. These measures include:

- Billing system upgrades;
- Active leak detection;
- Metering;
- Use of non-potable supplies for residential irrigation;
- Requiring wind/rain sensors for business and open space irrigation; and
- A rebate program for water efficient devices.

[7] Increases in total per capita per day use are reflective of a greater percentage of land being dedicated to non-residential uses.

APPENDIX F
TOWN OF FIRESTONE
Water Demands

The Town of Firestone is located 25 miles north of Denver in the northern Front Range of Colorado. In 2009, the Town served 3,006 water taps, with a service area population of about 9,750 persons. The Town supplies water to its customers only inside Town limits and receives treated water through a water supply agreement with the Central Weld County Water District. The District will provide Firestone with sufficient water to meet all its current and nearly all of its future needs as long as Firestone is responsible for contributing the raw water.

Historical Water Demands

Exhibits F-1 and F-2 provide historical population estimates, historical numbers of water taps by type, and annual growth rates for Firestone.

Exhibit F-1.
Town of Firestone Population Change, 1990 to 2009

Year	Population	Rate of Growth
1990	1,358	N.A.
1991	1,375	1.3%
1992	1,422	3.4%
1993	1,449	1.9%
1994	1,497	3.3%
1995	1,518	1.4%
1996	1,618	6.6%
1997	1,672	3.3%
1998	1,736	3.8%
1999	1,833	5.6%
2000	1,908	4.1%
2001	3,047	59.7%
2002	4,159	36.5%
2003	5,034	21.0%
2004	6,650	32.1%
2005	8,265	24.3%
2006	8,800	6.5%
2007	9,250	5.1%
2008	9,535	3.1%
2009	9,750	2.3%

Source: US Census Bureau, Colorado Department of Local Affairs, and Town of Firestone, 2010.

From 1990 through 2009, population grew by over 600 percent, or at an average annual rate of 11 percent. Population growth accelerated after year 2000, averaging almost 1,200 new persons per year, and slowed again after 2005.

Exhibit F-2.
Town of Firestone Water Taps, 1996 to 2009

Year	Residential	Multi-Family	Commercial	Irrigation	Government	Industrial	Total Taps	Rate of Growth
1996	449	NA	9	NA	NA	NA	458	N.A.
1997	467	NA	9	NA	NA	NA	476	3.9%
1998	494	NA	9	NA	NA	NA	503	5.7%
1999	573	NA	9	NA	NA	NA	582	15.7%
2000	857	NA	13	8	NA	NA	878	50.9%
2001	1,420	NA	19	24	NA	NA	1,463	66.6%
2002	1,697	NA	38	30	NA	NA	1,765	20.6%
2003	1,958	NA	48	39	NA	NA	2,045	15.9%
2004	2,209	NA	54	48	NA	NA	2,311	13.0%
2005	2,564	10	47	39	17	2	2,679	15.9%
2006	2,672	10	48	41	18	2	2,791	4.2%
2007	2,737	12	52	41	18	2	2,862	2.5%
2008	2,785	12	54	41	21	2	2,915	1.9%
2009	2,872	12	56	42	22	2	3,006	3.1%

Source: Town of Firestone, May 2010.

Total water taps increased by more than 550 percent, or at an average annual rate of 16 percent, from 1996 through 2009. Annual growth rates have fluctuated since 1990, with the most significant growth occurring between 2000 and 2005.

Potable water demands. Firestone tap and water use data prior to 1996 are unavailable. Historical potable water use from 1996 through 2009 is summarized by customer type in Exhibit F-3 below.

Exhibit F-3.
Potable Water Use by Customer Type for the Town of Firestone, 1996 to 2009, in Millions of Gallons

Year	Residential	Commercial	Irrigation	Government	Industrial	Multi-Family	Total Potable	Annual Percent Change
1996	77	NA	NA	NA	NA	NA	77	N.A.
1997	71	NA	NA	NA	NA	NA	71	-8.5%
1998	89	NA	NA	NA	NA	NA	89	25.3%
1999	83	NA	NA	NA	NA	NA	83	-6.9%
2000	109	15	11	NA	NA	NA	136	64.7%
2001	183	35	30	NA	NA	NA	249	83.0%
2002	246	46	35	NA	NA	NA	327	31.6%
2003	245	78	37	NA	NA	NA	360	10.1%
2004	266	84	48	NA	NA	NA	398	10.4%
2005	365	33	36	33	2	1	470	18.2%
2006	417	41	48	59	2	3	570	21.2%
2007	411	44	44	62	2	3	566	-0.8%
2008	427	57	49	69	2	3	607	7.2%
2009	357	55	41	62	1	2	518	-14.6%

Source: Town of Firestone, May, 2010.

Potable water demands rose by 570 percent, or at an annual average rate of 16 percent, from 1996 through 2009. Residential use has traditionally comprised the majority of potable water demands in the Town of Firestone, accounting for an average of 81 percent during the 1996 to 2009 period.

Exhibit F-4 presents residential and total gallons per capita per day and residential and total gallons per tap per day for 1996 through 2009.

Exhibit F-4.
Town of Firestone Potable Gallons per Capita and per Tap per Day

Year	Residential Use per Capita (gpcd)	Total Water Use per Capita (gpcd)	Residential Use per Residential Tap (gprtd)	Total Water Use per Total Tap (gptd)
1996	131	131	472	462
1997	116	116	415	407
1998	140	140	492	483
1999	123	123	395	389
2000	157	195	349	424
2001	165	224	353	466
2002	162	216	397	508
2003	133	196	343	483
2004	109	164	329	472
2005	121	156	453	481
2006	130	178	446	560
2007	122	168	421	542
2008	123	174	428	570
2009	100	146	351	472

Source: Figures are based on the data presented in Exhibits F-1, F-2 and F-3.

Residential and total water usage per capita per day has averaged 131 and 166 gallons, respectively, from 1996 through 2009. Residential and total water usage per residential or total tap per day has averaged 403 and 480 gallons, respectively, over the same period. Usage rates dropped in 2003 and 2004 due to drought and related restrictions and then again in 2009 due to timely precipitation. No trends in per capita or per tap water usage are apparent from 1996 to 2009.

Non-potable water demands. The Town of Firestone does not separately serve non-potable water demands as of 2010.

Total water requirements. Exhibit F-5 below indicates total potable water deliveries and total water requirements for the Town of Firestone from 1996 through 2009.

Exhibit F-5.
Total Water Requirements for the Town of Firestone, 1996 to 2009, in Millions of Gallons and Acre-Feet

Year	Potable MG	Total Potable and Non-Potable Water Deliveries MG	Total Water Deliveries AF	Total Water Requirements with System Losses AF
1996	77	77	237	264
1997	71	71	217	241
1998	89	89	272	302
1999	83	83	253	281
2000	136	136	417	464
2001	249	249	763	848
2002	327	327	1,004	1,116
2003	360	360	1,106	1,228
2004	398	398	1,221	1,356
2005	470	470	1,443	1,604
2006	570	570	1,750	1,944
2007	566	566	1,736	1,929
2008	607	607	1,862	2,069
2009	518	518	1,590	1,766

Source: Town of Firestone, May 2010.

CWCWD currently charges the Town of Firestone 20 percent for conveyance and treatment losses. Total water requirements reflect no distribution system losses for the Town. According to Town officials, the Town has a very new water distribution system and very accurate water metering.[1] From 1996 to 2008, water requirements varied somewhat but rose steadily, dropping off in 2009. Total water requirements increased by 570 percent from 1996 through 2009 (685 percent through 2008), or at an average annual rate of 16 percent (19 percent through 2008).

Projected Water Requirements

TST's projected water demands. The Town of Firestone provided the team with projections of water demand through 2050 in the Town's *Water Master Plan*, prepared by TST, Inc. Consulting Engineers, and dated 2003. TST projected a more than tripling of the Town's population by 2050 to 22,701 people. TST analyzed individual growth rates in residential units and commercial and irrigation taps and utilized a water usage rate of 150 gallons per capita per day to calculate future water demand projections. The *Water Master Plan* projections indicate a water demand of 4,939 acre-feet by 2050.

[1] Town of Firestone, March, 2010.

The Town of Firestone updated the population forecasts for this present study in 2010. This projection was based on past trends and future land developments and was considered reasonable by the study team, given available data.

Study team demand projections. The study team accepted the revised population forecast supplied by the Town of Firestone.[2] The revised population projections are presented in Exhibit F-6 below.

Exhibit F-6.
Population Forecasts for the Town of Firestone, 2010 to 2060

Year	Population
2010	10,000
2015	14,200
2020	17,700
2025	19,800
2030	21,800
2035	24,100
2040	26,600
2045	29,400
2050	32,400
2055	35,800
2060	39,500

Source: Town of Firestone, 2010.

Based on this growth pattern, the Town of Firestone is expected to reach more than 39,000 people by 2060. Residential, commercial and irrigation water usage are all expected to track population growth, assuming continued full potable water service. The study team applied the average total gpcd from 1996 through 2009 of 166 gallons to project future potable water demands.

Based upon discussions with the Town, the study team assumed that the Town will continue to serve all water needs with potable water, since it is party to a contract with the Central Weld County Water District that does not allow them to serve irrigation needs with non-potable water. The study team's water demand projections are presented in Exhibit F-7, below.

In April of 2010, the Town adopted a Raw Water Irrigation System Master Plan. The master plan will allow the Town to use native raw water rights in the Firestone area to satisfy a portion of its irrigation demands via a non-potable irrigation system, which will allow the Town's potable water to be put to a more beneficial use. The first phase of the raw water irrigation system will not be implemented for several years.

[2] Firestone Growth and Demand Projections spreadsheet, Town of Firestone, 2010.

Exhibit F-7.
Water Demand Projections for the Town of Firestone, 2010 to 2060, in Acre-Feet

Year	Potable Residential, Commercial and Irrigation	Total Water Deliveries	Total Water Requirements
2010	1,900	1,900	2,100
2015	2,600	2,600	2,900
2020	3,300	3,300	3,700
2025	3,700	3,700	4,100
2030	4,100	4,100	4,500
2035	4,500	4,500	5,000
2040	4,900	4,900	5,500
2045	5,500	5,500	6,100
2050	6,000	6,000	6,700
2055	6,700	6,700	7,400
2060	7,300	7,300	8,200

Source: Harvey Economics, 2010.

The study team assumed 10 percent CWCWD (CWCWD currently charges Firestone 20 percent, but they are negotiating a new agreement, which should reduce this surcharge to 10 percent[3]) charges to Firestone for losses. Total Firestone water requirements are projected to increase from 2,000 acre-feet in 2010 to 8,200 acre-feet in 2060, an increase of over 6,000 acre-feet. Water requirements are anticipated to increase by 296 percent from 2010 through 2060, or at average annual rate of 2.8 percent.

Conservation

Prior to the 2007 Water Conservation Plan (WCP), the Town of Firestone had acquired more CBT water than it needs and had only initiated voluntary water conservation measures. In the 2007 WCP, Firestone outlines four water conservation goals:

- Reduce residential gpcd by 5 percent (from 159 to 151);
- Reduce commercial water use by 5 percent;
- Reduce park water usage by 8 percent; and
- Reduce Open Space water use by 10 percent.

These reductions equal a total water savings of 222 AF over the ten year target period. These goals will be realized through a series of utility maintenance programs, regulatory measures, educational programs, and rebates and incentives.

[3] Firestone response to NISP questionnaire, March, 2010.

APPENDIX G
FORT COLLINS-LOVELAND WATER DISTRICT
Water Demands

The Fort Collins-Loveland Water District (FCLWD) is responsible for providing potable water to residential, commercial and industrial users within the 60 square miles that comprise the District's service area. The District provides service to customers within the limits and growth areas of the cities of Fort Collins, Loveland, Windsor, and Timnath and Larimer County. The District also wholesales over 306 acre-feet (AF) of potable water to the Town of Windsor for use in its own system. Windsor is responsible for providing its own raw water supply, so those demands were not included in this analysis. The District interconnects with the cities of Fort Collins and Loveland and with the North Weld County Water District. The District's largest single user is Mountain View Farms (formerly Duo Dairy), which has an average demand of 137,000 gallons per day. FCLWD is a co-owner of the Soldier Canyon Filter Plant (SCFP) with North Weld County and East Larimer County Water Districts.

Historical Water Demands

FCLWD's 2004 service area population is estimated at 39,020 persons served by 14,189 water taps.[1] Exhibit G-1 provides historical population estimates and total numbers of taps with annual growth rates from 1991 through 2010.

[1] These population estimates were derived assuming 2.75 persons per tap from a representative census tract within the District, US Census Bureau, 2000. Such an estimate is likely high, given that not all taps are residential.

Exhibit G-1.
FCLWD Population and Total Tap Change, 1991 through 2010

Year	Population	Taps	Annual Growth (Taps)	Annual Percent Growth
1991	10,956	3,984	N.A.	N.A.
1992	12,158	4,421	437	11.0%
1993	13,189	4,796	375	8.5%
1994	15,062	5,477	681	14.2%
1995	16,354	5,947	470	8.6%
1996	17,556	6,384	437	7.3%
1997	18,777	6,828	444	7.0%
1998	20,037	7,286	458	6.7%
1999	21,516	7,824	538	7.4%
2000	23,936	8,704	880	11.2%
2001	25,831	9,393	689	7.9%
2002	27,808	10,112	719	7.7%
2003	30,036	10,922	810	8.0%
2004	33,451	12,164	1,242	11.4%
2005	35,640	12,960	796	6.5%
2006	36,801	13,382	422	3.3%
2007	37,881	13,775	393	2.9%
2008	38,486	13,995	220	1.6%
2009	38,819	14,116	121	0.9%
2010*	39,020	14,189	73	0.5%

Source: FCLWD Master Plan Report 2008, July 2008; FCLWD, July 2010Harvey Economics, 2010.
The 2010 number is from mid-year.

From 1991 through 2009, FCLWD's number of taps grew 254 percent, or at an average annual rate of 7.3 percent. Annual growth rates for taps have fluctuated somewhat, but 2000 through 2005 marked a period of significant growth for the District, with an average of 856 new taps each year.

Potable water demands. Exhibit G-2 provides a breakdown of FCLWD's historical potable water use by consumer type for the period 1992 to 2009. The water use for the District's three largest users are shown individually

Exhibit G-2.
Potable Water Use by Customer Type for FCLWD, in Millions of Gallons, 1992 to 2009

Year	Residential, Commercial and Other	A&A Dairy	Front Range Community College	Mountain View Farms	Total	Annual Percent Change
1992	870	3	3	46	922	N.A.
1993	945	3	4	46	998	8.2%
1994	1,147	3	4	46	1,201	20.3%
1995	1,057	3	4	46	1,111	-7.5%
1996	1,268	4	5	46	1,323	19.1%
1997	1,299	4	5	46	1,354	2.3%
1998	1,432	4	6	46	1,488	9.9%
1999	1,511	5	6	46	1,568	5.3%
2000	2,045	6	8	46	2,105	34.3%
2001	2,133	6	8	46	2,194	4.2%
2002	2,213	7	8	46	2,274	3.6%
2003	1,809	5	7	46	1,867	-17.9%
2004	2,086	6	8	46	2,147	14.9%
2005	2,339	7	9	46	2,401	11.8%
2006	2,885	9	11	46	2,951	22.9%
2007	3,005	9	11	46	3,071	4.1%
2008	2,767	8	10	49	2,834	-7.7%
2009	2,325	8	9	50	2,392	-15.6%

Source: FCLWD, 2010.

These figures reflect potable water deliveries to the end user for customers within the District. From the total water deliveries from SCFP, the study team subtracted 3 percent of deliveries for distribution system losses.[2] Secondly, the team assumed that the deliveries not made to the top three largest users were to residential, commercial and other customers. Total potable water deliveries increased by 159 percent between 1992 and 2009 (207% between 1992 and 2008), or at an average annual rate of 5.8 percent (7.3% for 1992 to 2008). Deliveries decreased by nearly 18 percent between 2002 and 2003, illustrating the District's ability to reduce demands during drought.

Residential users have historically accounted for the majority of total deliveries; from 2004 through 2009, residential deliveries account for 73 percent of the total, with commercial and public users representing the remainder. Residential taps have constituted the majority of growth in taps and water usage from 1992 through 2009, as well.[3]

Exhibit G-3 provides total potable gallons, not including the top three largest users, per capita and per tap per day for the District from 1992 through 2009.

[2] Mike DiTullio, District Manager, FCLWD, personal interview, July 2010.
[3] Mike DiTullio, District Manager, FCLWD, personal interview, July 2010.

Exhibit G-3.
Potable Gallons per Capita and per Tap per Day for FCLWD

Year	Total Water Use* per Capita (gpcd)	Total Water Use* per Tap (gptd)
1992	196	539
1993	196	540
1994	209	574
1995	177	487
1996	198	544
1997	190	521
1998	196	539
1999	192	529
2000	234	644
2001	226	622
2002	218	600
2003	165	454
2004	171	470
2005	180	494
2006	215	591
2007	217	598
2008	197	542
2009	164	451

Source: Figures are based on the data presented in Exhibits G-1 and G- 2.
Not including large users.

FCLWD's total potable water usage per capita and per tap per day has averaged 197 and 542 gallons, respectively, from 1992 through 2009. Although consumption patterns were significantly lower in 2009 than in 2008, average usage per tap in the District from 1992 through 2009 accurately reflects usage patterns into the future.

Non-potable water demands. FCLWD does not serve any non-potable water.

Total water requirements. Exhibit G-4 indicates FCLWD's total potable and non-potable water deliveries from1992 through 2009.

Exhibit G-4.
Total Water Requirements for FCLWD, in Acre-Feet, 1992 to 2009

Year	Potable MG	Non-potable MG	Total Water Deliveries MG	Total Water Deliveries AF	Total Water Requirements with System Losses AF
1992	922	0	922	2,831	2,918
1993	998	0	998	3,063	3,158
1994	1,201	0	1,201	3,685	3,799
1995	1,111	0	1,111	3,408	3,514
1996	1,323	0	1,323	4,060	4,186
1997	1,354	0	1,354	4,154	4,283
1998	1,488	0	1,488	4,567	4,708
1999	1,568	0	1,568	4,810	4,959
2000	2,105	0	2,105	6,460	6,659
2001	2,194	0	2,194	6,733	6,941
2002	2,274	0	2,274	6,978	7,194
2003	1,867	0	1,867	5,731	5,908
2004	2,147	0	2,147	6,587	6,791
2005	2,401	0	2,401	7,367	7,595
2006	2,951	0	2,951	9,056	9,336
2007	3,071	0	3,071	9,426	9,717
2008	2,834	0	2,834	8,696	8,965
2009	2,392	0	2,392	7,340	7,567

Source: FCLWD, 2010.

Total water requirements reflect adjustments made to account for distribution system losses of approximately 3 percent. From 1992 through 2009, total water requirements increased by 159 percent, or at an average annual rate of 5.8 percent; they increased by 233 percent or at an average annual rate of 8.3 percent over the period 1992 to 2007.

Projected Water Requirements

TST Consulting's projected water requirements. FCLWD and TST provided the study team with the projected number of taps through build out (projected to be 2032).[4] The projections are based on a historical 2.5 percent growth rate and anticipated future land use. TST projected 22,520 total taps by 2026 with a total buildout for the District at 26,116 total taps. Newer information from FCLWD sets the number of taps at buildout at 28,800[5].

Study team water demand projections. The study team analyzed TST's methodology in these projections and confirmed that these techniques are generally sound for this evaluation, but that the projections should reflect more recent information. To arrive at water demand projections between now and 2060, the study team first re-estimated FCLWD's total tap projections for 2010 through 2060. Since 1991, total taps have grown by an average of 563 taps per year. Reflective of this past growth, taps were assumed to increase 3 percent per year until 2012, and then 2.5 percent per year thereafter. Exhibit G-5 provides the study team's updated

[4] TST Inc. Consulting Engineers, *Fort Collins – Loveland Water District Master Plan Report 2008* , July2008.
[5] Mike DiTullio, District Manager, FCLWD, personal interview, July, 2010.

total tap forecasts used to project the District's future water demands, including the 28,800 total tap buildout limitation.

Exhibit G-5.
Total Tap Forecasts for FCLWD, 2010 through 2060

Year	Total taps	Annual Growth (Taps)	Annual Percent Growth
2010	14,400	N.A.	N.A.
2015	16,500	420	2.7%
2020	18,600	420	2.5%
2025	21,100	500	2.5%
2030	23,800	540	2.5%
2035	27,000	640	2.5%
2040	28,800	360	1.3%
2045	28,800	0	0.0%
2050	28,800	0	0.0%
2055	28,800	0	0.0%
2060	28,800	0	0.0%

Source: Harvey Economics, 2010.

Based on the assumed rate of growth, FCLWD will reach 28,800 taps at buildout by 2040. The study team then applied the average gptd from 1992 to 2009 of 542 gallons to these taps from 2010 through 2060 to project total water requirements. The study team assumed that FCLWD would continue to serve no non-potable water demands and that the three largest users' water demands would remain constant in the future.[6] Exhibit G-6 provides projected water demands for the District through 2060.

[6] Mountain View Farms, April 2010.

Exhibit G-6.
Water Demand Projections for FCLWD, 2010 to 2060, in Acre-Feet

Year	Residential, Commercial and Other	A&A Dairy	Front Range Community College	Mountain View Farms	Total Water Deliveries	Total Water Requirements
2010	8,700	8	9	50	8,800	9,100
2015	10,000	8	9	50	10,100	10,400
2020	11,300	8	9	50	11,400	11,800
2025	12,800	8	9	50	12,900	13,300
2030	14,400	8	9	50	14,500	14,900
2035	16,400	8	9	50	16,500	17,000
2040	17,500	8	9	50	17,600	18,100
2045	17,500	8	9	50	17,600	18,100
2050	17,500	8	9	50	17,600	18,100
2055	17,500	8	9	50	17,600	18,100
2060	17,500	8	9	50	17,600	18,100

Source: Harvey Economics, 2010

An additional 3 percent was added to all water deliveries to account for system losses. Total water requirements are projected to almost double by 2060, or at average annual rate of 1.4 percent.

Conservation[7]

The goal for the Fort Collins-Loveland Water District's conservation plan is 13 percent (approximately 1,200 AF) per year. The measures taken / programs developed to meet this goal include:

- Improvements to billing software;
- Improved leak detection and repair program;
- A water waste regulation;
- Conservation inducing water rates; and
- ET irrigation scheduling included in the water bill.

[7] Clear Water Solutions, *Fort Collins-Loveland Water District Water Conservation Plan.* September 2008.

APPENDIX H
CITY OF FORT LUPTON
Water Demands

The City of Fort Lupton is located 25 miles northeast of Denver in the rural Front Range of Colorado. In 2009, the City served 2,282 water taps, with a service area population of about 7,500 persons. The City supplies water only inside its city limits and has a water treatment agreement with the City of Hudson, which is responsible for its own water supply and compensates Fort Lupton for water treatment. The Hudson agreement is not included in Fort Lupton's historical or future water demands, since Fort Lupton is not responsible for current or future Hudson water supplies.

Historical Water Demands

The City of Fort Lupton's current population is estimated at 7,463 persons, and the City's service area coincides with its city limits.[1] Exhibit H-1 provides historical population estimates, the number of total water taps, and annual growth rates for each.

Exhibit H-1.
City of Fort Lupton Population and Total Taps Change, 1990 to 2009

Year	Population	Annual Change	Total Taps	Annual Change
1990	5,159	N.A.	N.A.	N.A.
1991	5,398	4.6%	N.A.	N.A.
1992	5,459	1.1%	N.A.	N.A.
1993	5,586	2.3%	N.A.	N.A.
1994	5,674	1.6%	N.A.	N.A.
1995	5,785	2.0%	N.A.	N.A.
1996	5,879	1.6%	N.A.	N.A.
1997	5,988	1.9%	1,805	N.A.
1998	6,054	1.1%	1,901	5.3%
1999	6,215	2.7%	2,004	5.4%
2000	6,787	9.2%	2,111	5.3%
2001	7,154	5.4%	2,153	2.0%
2002	7,104	-0.7%	2,174	1.0%
2003	7,126	0.3%	2,139	-1.6%
2004	7,098	-0.4%	2,195	2.6%
2005	7,197	1.4%	2,213	0.8%
2006	7,190	-0.1%	2,254	1.9%
2007	7,289	1.4%	2,269	0.7%
2008	7,385	1.3%	2,284	0.7%
2009	7,463	1.1%	2,282	-0.1%

Source: US Census Bureau and City of Fort Lupton data, obtained October 2004; Colorado Department of Local Affairs, obtained May 2010.

[1] Colorado Department of Local Affairs, obtained May 2010.

From 1990 through 2009, population grew by 45 percent, or at an average annual rate of 2.0 percent. Total water taps increased by 19 percent, or at an average annual rate of 2.0 percent, from 1997 through 2009. According to the 2000 Census, the City's average persons per household was 3.23. Annual growth rates have fluctuated since 1990, with the most significant growth occurring from 1998 through2000.

Potable water demands. Historical potable water use is summarized by customer type in Exhibit H-2 below.

Exhibit H-2.
Potable Water Use by Customer Type for the City of Fort Lupton, 1997 to 2009, in Millions of Gallons

Year	Residential	Commercial and Industrial	Total Potable	Annual Percent Change	Total Non-Potable	Annual Percent Change
1997	210	60	270	N.A.	386	N.A.
1998	216	65	281	4.2%	517	34.0%
1999	212	62	274	-2.4%	538	4.1%
2000	256	62	318	15.9%	643	19.5%
2001	249	61	310	-2.5%	636	-1.2%
2002	248	61	309	-0.3%	558	-12.3%
2003	194	88	282	-8.8%	415	-25.6%
2004	195	57	252	-10.6%	478	15.1%
2005	210	61	271	7.6%	351	-26.5%
2006	308	90	398	47.0%	337	-4.1%
2007	250	73	323	-19.0%	400	18.8%
2008	270	79	348	7.9%	403	0.8%
2009	310	90	400	14.8%	395	-2.1%

Source: City of Fort Lupton and Harvey Economics, 2010.

Fort Lupton tap and water use data are unavailable prior to 1997. Potable water demands rose by 48 percent, or at an annual average rate of 3.3 percent, from 1997 through 2009. Residential use has traditionally comprised the majority of potable water demands in the City of Fort Lupton, accounting for an average of 77 percent during the 1997 to 2009 period. Exhibit H-3 presents residential and total gallons per capita per day and total gallons per total tap per day for 1997 through 2009.

Exhibit H-3.
Fort Lupton Potable Gallons per Capita and per Total Tap per Day

Year	Residential Water Use (gpcd)	Total Potable Water Use (gpcd)	Total Potable Water Use Per Total Tap (gptd)
1997	96	123	410
1998	98	127	405
1999	94	121	375
2000	103	128	413
2001	96	120	394
2002	96	119	389
2003	75	109	361
2004	75	97	314
2005	80	103	335
2006	117	152	484
2007	94	121	390
2008	100	129	418
2009	114	147	480

Source: Figures are based on the data presented in Exhibits H-1 and H- 2.

Residential and total water usage per capita per day has averaged 95 and 123 gallons, respectively, from 1997 through 2009. Total water usage per total tap per day has averaged 398 gallons over the same period. No trends in per capita or per tap water usage are apparent from 1997 to 2009. The City's average potable water usage per capita and per tap is lower than other water providers in the region because Fort Lupton has a higher ratio of persons per tap than other parts of the region and because the City uses a significant amount of non-potable water (addressed in the next section) to irrigate landscaping for the schools, city parks, golf course and other areas.

Non-potable water demands. A large portion of the City of Fort Lupton's water demands comes from non-potable water needs. From 1997 through 2009, Thermo Cogeneration power plant used, on average, 443 million gallons of water annually, while other non-potable users, including the City's parks and schools, outdoor irrigation and golf course, used 50 million gallons annually on average. These non-potable water deliveries are made with both groundwater and ditch water.

Thermo is the City's single largest water user, at 341 million gallons in 2009, and its demands are expected to remain stable into the future. To conservatively plan for Thermo's potential water needs, the study team assumes Thermo's demands into the future at its average use from 1997 to 2009 at 443 million gallons annually. Thermo pays the City to pump its groundwater and to run it through its distribution system to deliver the non-potable water to Thermo. The City is legally responsible for any augmentation needs from this water use from its own groundwater wells, though Thermo is contractually obligated to assist the City in securing any necessary water supplies for increased use.

Non-potable water usage for the City's parks and schools, outdoor irrigation, and the golf course from 1997 through 2004 was unmetered, but was metered from 2005 onwards. The average use for the metered years was 49 million gallons per year and use has been increasing.

Total water requirements. Exhibit H-4 below indicates total potable and non-potable water deliveries and total water requirements for the City of Fort Lupton from 1997 through 2009.

Exhibit H-4.
Total Water Requirements for the City of Fort Lupton, 1997 to 2009, in Millions of Gallons and Acre-Feet

Year	Potable MG	Non-potable MG	Total Potable and Non-Potable Water Deliveries MG	Total Potable and Non-Potable Water Deliveries AF	Total Water Requirements with System Losses AF	Annual Percent Change
1997	270	386	656	2,012	2,235	N.A.
1998	281	517	798	2,448	2,720	21.7%
1999	274	538	812	2,493	2,770	1.8%
2000	318	643	961	2,949	3,277	18.3%
2001	310	636	946	2,902	3,224	-1.6%
2002	309	558	867	2,659	2,955	-8.4%
2003	282	415	697	2,138	2,375	-19.6%
2004	252	478	729	2,239	2,487	4.7%
2005	271	351	622	1,908	2,120	-14.7%
2006	398	337	735	2,256	2,506	18.2%
2007	323	400	723	2,218	2,464	-1.7%
2008	348	403	751	2,306	2,562	4.0%
2009	400	395	795	2,439	2,710	5.8%

Source: Unpublished data provided by the City of Fort Lupton, May 2010.

Total water requirements reflect an adjustment made to account for approximate distribution system losses of 10 percent.[2] From 1997 to 2009, water requirements fluctuated because of weather, drought restrictions and varied demands at Thermo. Total water requirements increased by 21 percent from 1997 through 2009, or at an average annual rate of 1.6 percent. Peak water demands were reached in year 2000 at more than 3,200 acre-feet.

Projected Water Requirements

Water Conservation Plan's projected water demands. The City of Fort Lupton provided the team with projections of water demand through 2030 in the City's *Water Conservation Plan*, prepared by Clear Water Solutions Inc., and dated August 2007. The projections included forecasts of tap numbers based on 3 percent growth (from CDOLA) from 2006. A 173 gptd was then applied to this population forecast to estimate future water demands for the residential water use. A similar method of calculating the number of taps and

[2] Steve Nguyen, Applegate Group, telephone interview, October 2004.

applying a water use factor per tap was used for the commercial / industrial, school, multifamily, hotel / motel, and irrigation water use sectors.

The team analyzed the methods implemented by Clear Water Solutions in its forecasts and generally finds its approaches sound for the purposes of this study, though the team updated the data and subsequent assumptions upon which the forecasts were based.

Study team demand projections. To arrive at projections of total water demands between now and 2060 for the City of Fort Lupton, the study team first re-estimated population and total taps for the city. The team collected population figures for 1990 to 2009 (see Exhibit H-1). Presented in Exhibit H-5 below, the new data resulted in a revised average annual population growth rate of 2.0 percent instead of Clear Water Solutions' 3.0 percent.

Exhibit H-5.
Population Forecasts for the
City of Fort Lupton, 2010 to 2060

Year	Population
2010	7,600
2015	8,400
2020	9,300
2025	10,200
2030	11,200
2035	12,400
2040	13,700
2045	15,100
2050	16,600
2055	18,300
2060	20,200

Source: Harvey Economics, 2010.

The City of Fort Lupton is projected to reach over 20,000 people by 2060. Residential, commercial and industrial water usages (except Thermo) are all expected to track population growth. The study team applied a gpcd of 123 gallons, as the 123 gpcd is based upon an average gpcd from 1997 to 2009 of potable water served to residential, commercial and industrial users (excluding Thermo), which the team believes is the more appropriate measure of water usage for this purpose.

Based upon discussions with the City, the study team assumed that Thermo's non-potable usage and future non-potable usage for golf course irrigation will remain steady from 2003 to 2060, assuming normal year hydrology. The study team also assumed that current non-potable irrigation of schools, city parks and other irrigated lands will continue at the same rate into the future. Growth in irrigation, water usage for schools, parks and other green spaces, will grow with population, and will be served non-potable water. The study team's updated water demand forecasts are presented in Exhibit H-6 below.

Exhibit H-6.
Water Demand Projections for the City of Fort Lupton, 2010 to 2060, in Acre-Feet

Year	Potable	Thermo	Other Non-Potable	Total Water Deliveries	Total Water Requirements
2010	1,250	1,360	170	2,780	3,100
2015	1,360	1,360	190	2,910	3,200
2020	1,470	1,360	200	3,030	3,400
2025	1,600	1,360	220	3,180	3,500
2030	1,750	1,360	240	3,350	3,700
2035	1,910	1,360	260	3,530	3,900
2040	2,080	1,360	280	3,720	4,100
2045	2,280	1,360	310	3,950	4,400
2050	2,490	1,360	340	4,190	4,700
2055	2,720	1,360	370	4,450	4,900
2060	2,980	1,360	410	4,750	5,300

Source: Harvey Economics, 2010.

An additional 10 percent was added to all water demands to account for distribution system losses. Total Fort Lupton water requirements are projected to increase from 2,710 acre-feet in 2009 to 5,300 acre-feet in 2060, an increase of 2,590 acre-feet. Water requirements are anticipated to increase by 71 percent from 2005 through 2050, or at average annual rate of 1.1 percent.

Conservation[3]

The City of Fort Lupton has implemented a range of conservation measures, as outlined in its *2007 Water Conservation Plan*. The main goals of this plan are: to reduce residential water usage by 5 percent over the next ten years and 7 percent into the future (from 173 gpcd to 161 gpcd); to install a meter at the front end of the Thermo Power Plant (the largest water user); and to reduce city irrigation water use by 5 percent. The main points of the plan included:

- increasing the water treatment plant efficiency;
- rebates for rainfall and wind sensors;
- rebates for low-flow fixtures (toilets, showerheads, etc, but not clothes washers);
- leak identification and repair;
- water saving demonstrations including school programs;
- water facility tours;
- water bill informational inserts;

[3] Responses to a survey by the Northern Colorado Water Conservancy District, 2003.

- rate structure changes;
- city-wide watering restrictions;
- Irrigation equipment improvements at parks, schools, open spaces and the golf course;
- Replace turf with concrete at the golf course;
- Inject wetting agent at the golf course;
- Place wind/rain sensors at parks, schools, open spaces and the golf course; and
- Improve billing meters.

It is uncertain at this time how much water savings has been achieved between the implementation of the 2003 Drought Response Plan and since the implementation of this plan.

APPENDIX I
CITY OF FORT MORGAN
Water Demands

The City of Fort Morgan is responsible for providing water to residential, commercial, industrial, and irrigation users within the City's boundaries plus approximately 12 taps outside the City's boundaries. The City had assigned water service for Leprino Foods, a large commercial customer, to Morgan County Quality Water District through 2006, but water service switched back to the City of Fort Morgan in November 2006. The study team has noted this arrangement in its water demand projections. The City of Fort Morgan also serves Cargill Meat Solutions, a large commercial food processor, Western Sugar, and a Dairy Farmers of America Cooperative milk processing plant. The City of Fort Morgan traditionally has served its customers' water needs with groundwater, but, due to water quality compliance issues with nitrate levels, radioneuclides and extremely high water hardness, the City switched over completely to C-BT water in December 1999 to meet those demands. [1]

Historical Water Demands

Fort Morgan's 2009 service area population was estimated at 11,382 persons, and total residential, commercial and irrigation water taps numbered at 4,059.[2] Exhibit I-1 provides historical population estimates and annual growth rates.

[1] Ron Shaver, Director of Utilities, City of Fort Morgan, and John Turner, Treatment Plant Operator, personal interviews and emails, October and November 2004.

[2] City of Fort Morgan response to NISP Questionnaire from Northern Colorado Water Conservancy District, March, 2010.

Exhibit I-1.
City of Fort Morgan Population Change, 1990 through 2009

Year	Population	Rate of Growth
1990	9,068	N.A.
1991	9,384	3.5%
1992	9,568	2.0%
1993	9,649	0.8%
1994	9,855	2.1%
1995	10,016	1.6%
1996	10,150	1.3%
1997	10,273	1.2%
1998	10,180	-0.9%
1999	10,151	-0.3%
2000	11,034	8.7%
2001	11,104	0.6%
2002	11,149	0.4%
2003	11,151	0.0%
2004	11,095	-0.5%
2005	11,661	5.1%
2006	11,693	0.3%
2007	10,878	-7.0%
2008	10,834	-0.4%
2009	11,382	5.1%

Source: US Census Bureau, Colorado Department of Local Affairs, and City of Fort Morgan, 2010.

Fort Morgan's population grew 26 percent from 1990 through 2009, or at an average annual rate of 1.2 percent. Annual growth rates for population have fluctuated from a low of seven percent population loss to a high of nine percent population gain in 2000. Generally, growth in Fort Morgan has been slower than the growth seen for other Front Range Colorado communities, likely due to its greater distance from the Denver metro area.

Potable water demands. Exhibit I-2 provides a breakdown of historical potable water use by consumer type for the period 1995 through 2009.

Exhibit I-2.
Potable Water Use by Customer Type for the City of Fort Morgan, 1995 to 2009, in Millions of Gallons

Year	Residential[1]	Cargill Meat Solutions	Other Commercial, outside City and Irrigation[1]	Total Potable	Annual Percent Change
1995	496	503	172	1,171	N.A.
1996	567	575	197	1,339	14.3%
1997	551	559	191	1,301	-2.8%
1998	513	520	178	1,211	-6.9%
1999	422	428	146	996	-17.8%
2000	616	573	205	1,394	40.0%
2001	581	502	186	1,270	-8.9%
2002	537	570	190	1,297	2.1%
2003	284	444	125	853	-34.2%
2004	429	424	180	1,033	21.0%
2005	429	511	236	1,176	13.8%
2006	475	575	260	1,310	11.4%
2007	656	561	207	1,424	8.7%
2008	644	530	189	1,363	-4.3%
2009	619	562	97	1,278	-6.2%

Source: City of Fort Morgan, obtained May 2010.
[1]As of 2004, commercial water use is included in the residential column.

These figures reflect potable water deliveries to the end user for the City of Fort Morgan's customers. Reliable historical data exist as measured at the influent meter at the City's water treatment facility, reduced by a 5 percent treatment plant loss and a 2 percent distribution system loss to arrive at the total potable deliveries shown in Exhibit I-2.[3] The study team then relied upon a year 2000 analysis of water use for a water rate study to determine proportions of potable water delivered to residential, commercial and irrigation customers and to Cargill Meat Solutions.[4] The City was also able to provide actual measurements of potable water used by Cargill from 2000 through 2009, which helped refine the analysis in those years.[5]

Residential users have historically accounted for about 44 percent of total potable water deliveries, the largest users next to Cargill. Total potable water demands rose 9 percent from 1995 to 2009, with significant year to year variance. A sharp increase in water usage was noted from 1999 to 2000 when the City switched its water supplies from groundwater to C-BT. Average annual growth in potable water demands from 1995 through 2002 was 0.6 percent, half of the growth rate in city population over the same period.

Exhibit I-3 provides residential and total gallons per capita per day (gpcd) for 1995 to 2009.

[3]City of Fort Morgan response to NISP Questionnaire from Northern Colorado Water Conservancy District, May 2010.
[4] The Engineering Company, *City of Fort Morgan Water Rate Analysis*, November 2000.
[5] City of Fort Morgan response to NISP Questionnaire from Northern Colorado Water Conservancy District, May, 2010.

Exhibit I-3.
Potable Gallons per Capita and per Tap per Day, 1995 to 2009

Year	Residential Use per Capita (gpcd)	Total Water Use per Capita (gpcd)	Total Water Use per Capita, Less Cargill (gpcd)
1995	136	320	183
1996	153	361	206
1997	147	347	198
1998	138	326	186
1999	114	269	153
2000	153	346	204
2001	143	313	189
2002	132	319	179
2003	137	253	144
2004	137	255	150
2005	145	276	156
2006	154	307	172
2007	151	359	217
2008	156	345	211
2009	122	308	172

Source: Figures are based on the data presented in Exhibits I-1 and I- 2.

From 1995 through 2009, residential and total water use per capita per day (gpcd) has averaged 141 and 314 gallons, respectively. Total water use per capita, less Cargill's usage, averaged 181 gallons. No trends in per capita or per tap usage were apparent from 1995 through 2009.

Non-potable water demands. Starting with calendar year 2000, the City delivered only C-BT water to its customers, including residential, commercial and irrigation uses. Beginning in 2001, however, the City switched its outdoor irrigation uses back to non-potable groundwater. Irrigation demands served with non-potable groundwater have been metered from 2001 through 2003, when the City also began to serve some of Cargill Meat Solutions' water demands with non-potable groundwater. From 2003 forward, the City continued to use non-potable groundwater to serve these needs.[6] These non-potable deliveries experience distribution system losses of six percent.

Total water requirements. Exhibit I-4 presents the City of Fort Morgan's total potable and non-potable water deliveries and requirements from 1995 through 2009.

[6] City of Fort Morgan response to NISP Questionnaire from Northern Colorado Water Conservancy District, May, 2010.

Exhibit I-4.
Total Water Requirements for the City of Fort Morgan, 1995 to 2009, in Millions of Gallons and Acre-Feet

Year	Potable (MG)	Total Non-Potable (MG)	Total Potable and Non-Potable Water Deliveries (MG)	Total Water Deliveries (AF)	Total Water Requirements with System Losses (AF)
1995	1,171	N.A.	1,171	3,595	3,863
1996	1,339	N.A.	1,339	4,110	4,416
1997	1,301	N.A.	1,301	3,994	4,292
1998	1,211	N.A.	1,211	3,717	3,994
1999	996	N.A.	996	3,056	3,284
2000	1,394	N.A.	1,394	4,277	4,596
2001	1,270	131	1,401	4,298	4,615
2002	1,297	170	1,467	4,502	5,448
2003	853	313	1,166	3,578	4,330
2004	1,033	321	1,353	4,154	5,026
2005	1,176	231	1,407	4,319	5,227
2006	1,310	207	1,518	4,657	5,636
2007	1,424	200	1,624	4,985	6,032
2008	1,363	191	1,554	4,768	5,769
2009	1,278	159	1,437	4,409	5,335

Source: City of Fort Morgan, obtained May, 2010.

Total water requirements reflect adjustments made to account for approximate system losses of seventeen percent, including an assumed 10 percent conveyance loss or charge, 5 percent water treatment plant losses for potable water deliveries and 2 percent distribution system losses for both potable and non-potable deliveries.[7] Peak water requirements occurred in year 2007 at about 6,000 acre-feet. From 1995 to 2009, total water requirements increased by 38 percent, or at an average annual rate of 2.3 percent.

Projected Water Requirements

City of Fort Morgan population projections. The City of Fort Morgan provided the study team with projected population through 2025 from its *2003 Comprehensive Plan*.[8] The City analyzed historical growth patterns and referenced the Colorado Department of Local Affair's population projections for 2000 to 2025 for Morgan County to determine a 1.7 percent annual increase in population for the City of Fort Morgan. The study team analyzed the City's population projections and determined that the methods and assumptions are satisfactory for water demand forecasting.

[7] City of Fort Morgan response to NISP Questionnaire from Northern Colorado Water Conservancy District, May 2010.
[8] City of Fort Morgan, *City of Fort Morgan Comprehensive Plan*, 2003.

Study team water demand projections. As of 2010, the City of Fort Morgan did not have its own projections of future water demands. Therefore, the study team developed them for the NISP EIS.

The study team first updated the population projections as its first step. The study team applied the City's 1.7 percent annual growth rate in population from 2010 to 2025 and extended that same rate through 2060.[9] The study team updated its projections with US Census Bureau population estimates for the City, which resulted in ultimate population projections that are slightly different than those forecasted by the City in its *Comprehensive Plan*. Exhibit I-5 provides the study team's population forecasts used to project Fort Morgan's future water demands.

Exhibit I-5.
Population Projections for the City of Fort Morgan, 2010 to 2050

Year	Population
2010	11,600
2015	12,600
2020	13,700
2025	14,900
2030	16,200
2035	17,600
2040	19,200
2045	20,900
2050	22,700
2055	24,700
2060	26,900

Source: Harvey Economics, 2010.
City of Fort Morgan, *Comprehensive Plan*, 2003.

Based on the assumed growth rate, the City of Fort Morgan will grow to 14,900 persons by 2025 and to 26,900 persons by 2060.

To project future water demands for the City, the study team projected potable demands from the residential and commercial sectors. The study team assumed that these sectors would use 181 gallons, the average total water use per capita per day, which excludes Cargill Meat Solutions. Second, the study team assumed that Cargill's potable and non-potable use would remain constant through 2060.[10] The study team made the same assumption for the other large water users in Fort Morgan. The study team assumes that the average level for the 2007 to 2009 period of the large industrial users (2,370 AF), which is the only period where all the current large users are served by Fort Morgan, for long term projections.

[9] The Colorado Department of Local Affairs predicts a 1.9 percent annual growth rate in population from 2000 through 2030 for Morgan County, in which the City of Fort Morgan is situated, as a point of reference. Data obtained October 2004.
[10] Assumption from Cargill Meat Solutions, May 2010.

Finally, the study team assumed that non-potable irrigation water use would also remain constant at the average historical. The results of these potable and non-potable water demand projections for 2005 through 2060 are presented in Exhibit I-6 below.

Exhibit I-6.
Water Demand Projections for the City of Fort Morgan, 2010 to 2050, in Acre-Feet

Year	Residential and Other Commercial	Industrial	Total Potable	Total Non-Potable	Total Water Deliveries	Total Water Requirements
2010	2,400	2,370	4,800	690	5,500	6,600
2015	2,600	2,370	5,000	690	5,700	6,900
2020	2,800	2,370	5,200	690	5,900	7,100
2025	3,000	2,370	5,400	690	6,100	7,300
2030	3,300	2,370	5,700	690	6,400	7,700
2035	3,600	2,370	6,000	690	6,700	8,100
2040	3,900	2,370	6,300	690	7,000	8,400
2045	4,200	2,370	6,600	690	7,300	8,800
2050	4,600	2,370	7,000	690	7,700	9,300
2055	5,000	2,370	7,400	690	8,100	9,800
2060	5,500	2,370	7,900	690	8,600	10,400

Source: Harvey Economics, 2010.

An additional 17 percent was added to all potable demands to account for conveyance, treatment and distribution system losses, and only an additional 12 percent was added to all non-potable demands to account for those same conveyance and distribution system losses. Total water requirements for the City of Fort Morgan are projected to increase 58 percent from 2010 through 2060, or 3,800 acre-feet.

Conservation[11]

Currently, the City of Fort Morgan has implemented the following water conservation activities:

- leak detection and repair / monitoring of unaccounted for water;
- distribution system efficiency;
- public education;
- xeriscape demonstration gardens;
- landscape efficiency of City property; and
- working with the largest industrial water users to help them conserve water.

[11] City of Fort Morgan, *Water Conservation Plan*, June 1996. Ron Shaver, Director of Utilities, City of Fort Morgan, personal interview, October 2004.

Since these activities were implemented (in the June, 2006 Water Conservation Plan), the City has saved over 500 AF. In the 2008 Water Conservation Plan, Fort Morgan identified the following new measures:

- adoption of the 2003 international plumbing code mandating water conserving fixtures;
- expand landscape efficiency program;
- industrial and commercial water audits;
- water recycling systems;
- expand distribution system efficiency;
- customer water use audits;
- billing and rate structures designed to encourage efficiency; and
- water conserving fixture rebates.

The City of Fort Morgan has no estimate on the quantity of water that they expect to save from these programs.

APPENDIX J
TOWN OF FREDERICK
Water Demands

The Town of Frederick is located 25 miles north of Denver and is physically split by Interstate Highway 25 into an eastern and western portion. Frederick's western part receives water service from the Left Hand Water District (LHWD), which is also a current NISP participant. Hence, the demands for this portion of Frederick are included in the LHWD demands and addressed in their section of this report. Frederick supplies water to its customers inside the Town limits and also serves the unincorporated area of Weld County known as Evanston. The Town operates and maintains its own water distribution system in this eastern part of Town. The Town has a water supply agreement with CWCWD in which the Town provides raw water rights which CWCWD treats and delivers as potable water to serve this eastern part of town. This analysis for Frederick encompasses only the eastern portion of the town.

Historical Water Demands

The Town of Frederick's 2009 east-of-I-25 population is estimated at 7,400 persons. Exhibit J-1 provides historical population estimates for the east side of the Town of Frederick. The study team estimated east side population figures for 1990 through 2009 using the average proportion of the housing stock on the east side of I-25 from 2004 through 2009.

Exhibit J-1.
Town of Frederick Population, 1990 to 2009

Year	Population	Rate of Growth
1990	920	N.A.
1991	961	4.5%
1992	1,016	5.7%
1993	1,055	3.8%
1994	1,191	12.9%
1995	1,399	17.4%
1996	1,637	17.0%
1997	1,877	14.7%
1998	2,046	9.0%
1999	2,187	6.9%
2000	2,262	3.4%
2001	3,036	34.3%
2002	3,763	23.9%
2003	4,523	20.2%
2004	5,005	10.6%
2005	5,893	17.7%
2006	7,157	21.4%
2007	7,289	1.8%
2008	7,318	0.4%
2009	7,435	1.6%

Source: US Census Bureau and Colorado Department of Local Affairs, obtained July 2005, and Town of Frederick, 2010.

From 1990 through 2009, population grew by more than 700 percent, or at an average annual rate of 12 percent. Annual growth rates have fluctuated since 1990, with the most significant growth occurring between 2001 and 2006.

Potable water demands. Historical potable water use for the eastern portion of Frederick is summarized by customer type in Exhibit J-2 below.

Exhibit J-2.
Potable Water Sales to Eastern Portion Customers in the Town of Frederick, 1990 to 2009, in Millions of Gallons

Year	Potable Sales to Eastern Portion	Annual Percent Change
1990	56	N.A.
1991	63	13.6%
1992	68	7.5%
1993	64	-5.6%
1994	76	18.3%
1995	71	-6.6%
1996	80	13.1%
1997	78	-3.2%
1998	NA	NA
1999	105	35.4%
2000	172	63.6%
2001	227	31.8%
2002	259	14.3%
2003	252	-2.8%
2004	377	49.7%
2005	426	13.0%
2006	520	22.1%
2007	493	-5.1%
2008	494	0.1%
2009	477	-3.4%

Source: Town of Frederick, May, 2010.

Potable water demands rose by 788 percent, or at an annual average rate of 13 percent, from 1990 through 2008; usage declined marginally in 2009 with the wet summer.

Exhibit J-3 presents total gallons per capita per day for 1990 through 2009 for Frederick's eastern portion.

Exhibit J-3.
Town of Frederick Potable Gallons per Capita per Day

Year	Total Water Use per Capita (gpcd)
1990	166
1991	180
1992	183
1993	167
1994	175
1995	139
1996	134
1997	113
1998	N.A.
1999	132
2000	208
2001	204
2002	188
2003	152
2004	206
2005	198
2006	199
2007	185
2008	185
2009	176

Source: Figures are based on data presented in Exhibits J-1 and J-2.

Water usage per capita per day for Frederick's eastern portion averaged 173 gallons from 1990 through 2009. Usage rates dropped in 2003 due to drought and related restrictions. No trends in per capita water usage are apparent from 1990 to 2009.

Non-potable water demands. The Town of Frederick did not supply non-potable water until 2005 when the Town began using non-potable water to irrigate Town open spaces and public buildings. The Town's future non-potable water demands were projected in a 2004 rate study performed by Civil Resources.

Total water requirements (eastern portion). Exhibit J-4 below indicates potable water deliveries and water requirements for the Town of Frederick from 1990 through 2009.

Exhibit J-4.
Water Requirements for the Town of Frederick, 1990 to 2009, in Millions of Gallons and Acre-Feet

Year	Potable Water Deliveries (MG)	Potable Water Deliveries (AF)	Water Requirements with System Losses (AF)
1990	56	171	216
1991	63	194	245
1992	68	209	263
1993	64	197	249
1994	76	233	294
1995	71	218	275
1996	80	246	311
1997	78	238	301
1998	NA	NA	NA
1999	105	322	407
2000	172	527	666
2001	227	695	878
2002	259	794	1,003
2003	252	772	975
2004	377	1,156	1,460
2005	426	1,306	1,649
2006	520	1,595	2,014
2007	493	1,514	1,912
2008	494	1,515	1,913
2009	477	1,463	1,847

Note: Water requirements include a system loss of 1 percent and a CWCWD treatment surcharge of 20 percent.
Source: Civil Resources, July 2005; Town of Frederick, May 2010.

Total water requirements for the eastern portion reflect conveyance and distribution losses amounting to a combined 21 percent. These numbers include a contractual requirement for Frederick to provide CWCWD with 120% of the actual metered treated water.[1] From 1990 to 2009, water requirements varied somewhat but rose steadily. Total water requirements increased by 757 percent from 1990 through 2009, or at an average annual rate of 12 percent. The eastern portion of the Town reached peak water demands in 2006 at 2,014 acre-feet.

Projected Water Requirements

To arrive at projections of total water demands between now and 2060 for the Town of Frederick, the study team first estimated the Town's population using data from the comprehensive planning process. That process indicates that the Town is planning for roughly 52,500 total residents in the eastern portion of the town at buildout, based on land

[1] Town of Frederick response to NISP Questionnaire from Northern Colorado Water Conservancy District, May, 2010.

use designations and estimated development densities. The town also provided guidance on future growth rates. The historical growth rate of 12 percent is unsustainable, but the growth rate of the last few years (approximately 1 percent) is also unrealistically low. Frederick suggested a growth rate of 1 percent for 2010 and 2011, 2 percent for 2012, 3 percent for 2013 and 4 percent for 2014 through 2030. The study team accepted the town's 2030 population projection of 15,500 people for the eastern portion, but assumed that growth rates would be constant, or about 3.7 percent, and assumed that rate would continue through 2060. The study team's population projections are presented in Exhibit J-5 below.

Exhibit J-5.
Population Forecasts for the Town of Frederick, 2010 to 2060

Year	Population
2010	7,500
2015	9,000
2020	10,800
2025	12,900
2030	15,500
2035	18,600
2040	22,300
2045	26,800
2050	32,100
2055	38,500
2060	46,100

Source: Harvey Economics, 2010.

The Town of Frederick is expected to include more than 46,000 people by 2060. Water usage is expected to track population growth. The study team applied the average of total gpcd from 1990 through 2009 of 173 gallons to project future water demands. The Town of Frederick provided the study team with projections of non-potable water demand through 2014. The study team incorporated these data into its overall water demand projections by adding them to the projected potable demands.

By 2060, the study team assumed growth in non-potable water demands to reach 2000 acre feet. The non-potable annual growth rate of four percent is slightly less than the Town projected, reflecting either less non-potable development or a partial substitution for potable demand. This rate is equivalent to the population growth because the Town of Frederick is planning to expand their non-potable water system[2].

The study team's water demand projections are presented in Exhibit J-6 below.

[2] Dick Leffler, Town of Frederick Engineer, September, 2010.

Exhibit J-6.
Water Demand Projections for the Town of Frederick, 2010 to 2060, in Acre-Feet

Year	Total Potable	Non-Potable	Total Water Deliveries	Total Water Requirements
2010	1,460	170	1,630	2,100
2015	1,750	300	2,050	2,600
2020	2,090	370	2,460	3,100
2025	2,510	460	2,970	3,800
2030	3,010	560	3,580	4,500
2035	3,610	700	4,310	5,400
2040	4,330	860	5,190	6,600
2045	5,190	1,060	6,250	7,900
2050	6,220	1,310	7,540	9,500
2055	7,460	1,620	9,080	11,500
2060	8,950	2,000	10,950	13,800

Source: Harvey Economics, 2010.

The study team assumed 21 percent total system losses which includes the contractual requirement that the Town provide 120 percent of the actual metered treated water in raw water to CWCWD[3]. Total Frederick water requirements are projected to increase from 2,100 acre-feet in 2010 to 13,800 acre-feet in 2060, an increase of 11,700 acre-feet. Water requirements are anticipated to increase by 574 percent from 2010 through 2060, or at average annual rate of 3.9 percent.

Conservation[4]

The Town of Frederick encourages developers to seek conservation alternatives like smaller lot sizes, xeriscaping and non-potable irrigation systems and rewards them by requiring smaller water dedications for successful applications. The Town adopted an increasing block rate structure for potable water in 2005. The Municipal Code includes outdoor watering regulations limiting watering to even-odd addresses on alternating days during the summer months. It also prohibits outdoor watering in the afternoon. These restrictions are currently not mandatory but can be made mandatory by a simple vote of the Town Board. The Town adjusts watering of parks to reduce usage during rainy periods. The Town estimates that the current conservation methods provide a 10 percent water savings. The Town has been notified recently that its application for assistance in funding a water conservation plan has been approved by the Colorado Water Conservation Board (CWCB). This conservation plan has a reduction goal of 20 percent of the potable water usage.

[3] Town of Frederick response to NISP Questionnaire from Northern Colorado Water Conservancy District, May 2010.
[4] Dick Leffler, Town of Frederick Engineer, May 2010.

APPENDIX K
CITY OF LAFAYETTE
Water Demands

The City of Lafayette is responsible for providing water to residential, commercial, industrial, and irrigation users within the City's boundaries. The City also provides water to the East Boulder County and Baseline Water Districts to serve certain rural residential customers. As of 2010, Lafayette did not serve any large water users.

Historical Water Demands

Lafayette's 2009 population is estimated at 26,451 persons. Exhibit K-1 provides historical population estimates, numbers of residential units, and annual growth rates for each.

Exhibit K-1.
City of Lafayette Service Area Population and Residential Unit Change, 1979 through 2009*

	Population		Residential Units	
Year	Total	Annual Change	Total	Annual Change
1979	8,591	N.A.	3,765	N.A.
1980	8,985	4.6%	4,086	8.5%
1981	9,786	8.9%	4,309	5.5%
1982	10,685	9.2%	4,666	8.3%
1983	11,751	10.0%	5,016	7.5%
1984	12,634	7.5%	5,492	9.5%
1985	13,323	5.5%	5,675	3.3%
1986	13,750	3.2%	5,789	2.0%
1987	13,995	1.8%	5,817	0.5%
1988	14,221	1.6%	5,823	0.1%
1989	14,405	1.3%	5,829	0.1%
1990	15,502	2.1%	5,848	0.3%
1991	15,698	1.3%	5,940	1.6%
1992	16,178	3.2%	6,062	2.1%
1993	16,591	2.6%	6,516	7.5%
1994	17,677	6.8%	6,838	4.9%
1995	18,463	4.6%	7,389	8.1%
1996	19,862	7.9%	7,745	4.8%
1997	20,637	4.0%	8,123	4.9%
1998	21,584	4.7%	8,814	8.5%
1999	22,926	6.4%	9,145	3.8%
2000	23,277	1.5%	9,115	-0.3%
2001	24,472	5.3%	9,392	3.0%
2002	24,806	1.4%	9,515	1.3%
2003	25,253	1.8%	9,755	4.0%
2004	25,663	1.6%	9,913	1.6%
2005	26,195	2.1%	10,119	2.1%
2006	26,566	1.4%	10,262	1.4%
2007	26,665	0.3%	10,300	0.3%
2008	27,175	1.9%	10,497	1.9%
2009	27,466	1.1%	10,610	1.1%

* Prior to 1990, population is for the City of Lafayette only.
Source: City of Lafayette document, *City of Lafayette Growth Rate,* obtained September 2004, City of Lafayette Document, "City of Lafayette Water Consumption", obtained March, 2010. HE, 2010.

From 1979 through 2009, population grew at an average annual rate of 3.8 percent, whereas the growth rate for the total number of residential units was 3.6 percent. Annual growth rates for both population and the number of residential units have fluctuated. Significant growth, ranging from 8 to 10 percent per year, occurred during the early 1980s and mid 1990s, followed by periods of relatively slower growth.

In November 1995, Lafayette imposed growth restrictions that limited the number of new residential dwelling permits to 200 per year. These restrictions were amended in 2000 to allow for an additional 50 affordable, permanently deed-restricted units per year. Since 1995,

the total number of new housing units has varied between 691 and 34. This variability reflects, on the high side, a backlog of projects that were planned prior to the restrictions[1] and, on the low side, the results of the nation-wide housing slump at that time. The loss of housing units in 2000 is assumed to be based on the different methodologies for the census count and the City of Lafayette's count.

Average housing unit size steadily grew between 1980 and 1990. Over this period the number of persons per household increased from 2.28 to 2.52.[2] The number of persons per household has since stabilized. As of 2000, the number of persons per housing unit was 2.45.

Potable water demands. Exhibit K-2 provides a breakdown of historical potable water use by consumer type for the period 1994 to 2009.

Exhibit K-2.
Potable Water Use by Customer Type for the City of Lafayette, 1994 to 2009, in Millions of Gallons

	Residential								
Year	Single Family	Multi Family	Total	Commercial	Industrial	Irrigation	Other	Total	Annual Percent Change
1994	510	202	713	94	9	39	15	870	N.A.
1995	493	174	667	86	7	37	10	807	-7.2%
1996	565	180	745	100	7	48	13	914	13.2%
1997	628	170	798	103	9	53	13	976	6.8%
1998	742	183	925	126	13	80	15	1,159	18.8%
1999	679	201	881	133	15	77	16	1,122	-3.2%
2000	755	238	994	146	16	101	15	1,272	13.4%
2001	774	234	1,008	150	13	114	14	1,299	2.1%
2002	565	177	742	105	16	41	21	923	-28.9%
2003	685	188	872	139	18	117	22	1,169	26.6%
2004	621	185	806	133	13	121	19	1,091	-6.6%
2005	685	191	876	161	16	173	23	1,249	14.5%
2006	787	203	990	188	25	202	29	1,434	14.8%
2007	744	194	938	146	46	181	29	1,341	-6.5%
2008	746	201	947	157	44	183	30	1,361	1.5%
2009	670	194	864	137	40	119	29	1,189	-12.6%

Source: City of Lafayette document, *Total Water Consumption,* obtained September 2004. City of Lafayette, May 2010.

These figures reflect potable water deliveries to the end user for customers within and outside the City.[3] Residential users have historically accounted for the majority of total deliveries; however, analysis of use by customer type between 1994 and 2009 suggests that non-residential use has grown as a percentage of total use. In 2009, residential use accounted for 73 percent of total deliveries, down from 82 percent in 1994. On average, residential users have accounted for 76 percent of annual use.

Total potable water deliveries increased by 37 percent between 1994 and 2009, or at an average annual rate of 2.1 percent. Deliveries decreased by nearly 30 percent between 2001

[1] Telephone interview, Bonnie Star, City of Lafayette, October 2004.
[2] City of Lafayette document, *City of Lafayette Growth Rate*, obtained September 2004.
[3] In 2009, deliveries to customers within the East Boulder County and Baseline Water Districts accounted for only six percent of total deliveries, or 72 million gallons.

and 2002, indicating the City's ability to reduce demands during drought. Due primarily to timely precipitation, 2009 was a low water use year.

Exhibit K-3 provides residential and total gallons per capita per day for 1994 to 2009.

Exhibit K-3.
Residential and Total Gallons per Capita per Day

Year	Residential	Total
1994	110	135
1995	99	120
1996	103	126
1997	106	130
1998	117	147
1999	105	134
2000	117	150
2001	113	145
2002	82	102
2003	95	127
2004	86	116
2005	92	131
2006	102	148
2007	96	138
2008	95	137
2009	86	119

Source: Figures are based on the data presented in Exhibits K-1 and K-2.

Residential and total per capita per day has averaged 100 and 131 gallons, respectively. Although consumption patterns were lower in 2002 and 2003, analysis of the data did not reveal any meaningful trends in per capita per day use.

Non-potable water demands. The City of Lafayette supplies approximately 410 acre-feet of non-potable water to meet the irrigation needs of the City's golf course and landscaping along Highway 287. The golf course receives approximately 280 acre-feet of non-potable water annually.

Total water requirements. Exhibit K-4 indicates total potable and non-potable water deliveries by the City of Lafayette from 1994 through 2009.

Exhibit K-4.
Total Water Requirements for the City of Lafayette, 1994 to 2009, in Acre-Feet

Year	Potable Water Deliveries	Non-Potable Deliveries	Total Water Deliveries	Total Water Requirements
1994	2,620	0	2,620	2,848
1995	2,430	0	2,430	2,641
1996	2,763	0	2,763	3,003
1997	2,953	325	3,278	3,535
1998	3,510	325	3,835	4,140
1999	3,393	325	3,718	4,013
2000	3,856	325	4,181	4,516
2001	3,942	325	4,267	4,610
2002	2,770	325	3,095	3,336
2003	3,476	325	3,801	4,103
2004	3,348	337	3,685	3,976
2005	3,834	388	4,222	4,555
2006	4,400	425	4,825	5,208
2007	4,115	575	4,690	5,048
2008	4,176	336	4,512	4,876
2009	3,650	327	3,977	4,294

Source: City of Lafayette document, *Total Water Consumption,* obtained September 2004.
City of Lafayette's Water System Master Plan, May 2004.

Total water requirements reflect adjustments made to account for approximate system losses of 8 percent, including average treatment and distribution losses of 1.5 and 6.5 percent, respectively.[4] Over the period of record, total water requirements increased by 51 percent, or at an average annual rate of 2.8 percent (83 percent and 5.2 percent respectively if the maximum (2006) values are used).

Projected Water Requirements

McLaughlin Rincon projected water requirements. The City of Lafayette provided the study team with projected potable and non-potable water demands at buildout, which were prepared by McLaughlin Rincon. These buildout projections are found in the 2004 *Water System Master Plan* and were based on anticipated land use patterns within the City's urban growth boundaries.[5] Land use projections are included in Table II-D of the *Water System Master Plan*. These data have not been updated since 2004.

Projected potable demands. McLaughlin Rincon utilized 2001 plant production data to identify "average" year use data for each user type. Climatological data indicated that 2001

[4] McLaughlin Rincon, *Water System Master Plan for Lafayette*, May 2004, Pg. II-7; City of Lafayette, *Water Conservation Plan May 2009 Updated April 2010*, May 2010.
[5] McLaughlin Rincon, *Water System Master Plan for Lafayette*, May 2004.

was near average, and comprehensive use data were available.[6] Exhibit K-5 provides the per acre-foot demand factors used to derive potable demands.

Exhibit K-5.
Lafayette Master Plan Per Acre Demand Factors

Land Use Category	AF/Acre/Year
Parks	3.00
Single Family Residence	0.50
Multifamily Residence	0.25
Office	1.04
Institutional/Public	1.03
Retail	1.61
Industrial	0.40

Source: McLaughlin Rincon, *Water System Master Plan for Lafayette,* May 2004, Table II-A.

To arrive at projected potable demands, the number of newly developed acres by type of use was multiplied by the per acre-foot demand factors presented in Exhibit K-5. Total projected potable deliveries at buildout, including existing deliveries, were estimated to be 6,950 acre-feet.[7]

The study team evaluated the methodology utilized by McLaughlin Rincon and found that the methods used to project potable water demands at buildout were generally sound, given the availability of data.

Projected non-potable demands. Non-potable demands were also projected in the McLaughlin Rincon study.[8] The study identified six areas (329 acres of irrigable land) as likely future candidates to be served by non-potable supplies. Based on an application rate of 3 acre-feet per acre per year, total projected non-potable demands were estimated at 986 acre-feet per year.

The study team evaluated the methodology utilized by McLaughlin Rincon and found that while the methods used to calculate non-potable water demands were generally sound given the scope of the *Water System Master Plan*, consultation with Lafayette suggested a need to revise these methods for the purposes of this study.[9]

The City indicated that these figures represented an upper bound on non-potable demand dependent on the future costs associated with, among other things, the development of potable and non-potable supplies. Based on discussions with the City of Lafayette, the study team adjusted projected non-potable demands at buildout to reflect the midway point of current non-potable use and the upper bound provided by McLaughlin Rincon, or a total of

[6] McLaughlin Water Engineers, Ltd, *Water Demand Study for the City of Lafayette*, February 2003.
[7] This estimate reflects a study team adjustment of 6.5 percent to account for delivery losses between the water treatment plant and end user.
[8] "These requirements have not been included in the potable water needs." (McLaughlin Rincon, Pg. II-6).
[9] City of Lafayette telephone interview, Doug Short, October 2004.

658 acre-feet per year.[10] The remaining 328 acre-feet of demand, which must be met, were added to potable demands.

Projected total water deliveries for the City of Lafayette at buildout adjusted for system losses are 8,033 acre-feet, including 7,375 acre-feet of potable use and 658 acre-feet of non-potable use.[11]

Study team demand projections. To arrive at water demand projections for the City of Lafayette between now and buildout, the study team first estimated the City's total housing units at buildout. Based on projected land use patterns, buildout will result in an additional 3,580 residential units. Assuming 2.54 persons per housing unit, total population at buildout will be approximately 36,700 people.[12]

The City of Lafayette provided the study team with housing unit forecasts based on an assumed 200 new units per year, as defined by the limits of Lafayette's growth restrictions.[13] These projections seem reasonable given recent trends and the City's growth restrictions. Assuming 2.54 persons per housing unit, population within the City of Lafayette is projected to grow by 508 persons per year. By comparison, the City of Lafayette has grown by an average of 595 persons per year since 1990.

Exhibit K-6 provides the population and dwelling unit forecasts used to project Lafayette's future water demands.

Exhibit K-6.
Population and Dwelling Unit Forecasts for the City of Lafayette, 2010 to 2050

Year	Number of Dwellings	Population	Annual Growth Rate
2010	10,800	28,000	1.3%
2015	11,800	30,500	1.8%
2020	12,800	33,100	1.6%
2025	13,800	35,600	1.5%
2030	14,200	36,700	0.6%
2035	14,200	36,700	0.0%
2040	14,200	36,700	0.0%
2045	14,200	36,700	0.0%
2050	14,200	36,700	0.0%
2055	14,200	36,700	0.0%
2060	14,200	36,700	0.0%

Source: City of Lafayette and Harvey Economics, 2010.

[10] The resulting total is also consistent with the City's response to the Windy Gap Questionnaire.
[11] McLaughlin Rincon, *Water System Master Plan for Lafayette*, May 2004 and Harvey Economics, 2004.
[12] The land use plans used to determine the number of new residential units was based on development as of January 2002. To arrive at buildout population, the projected total number of new people was added to 2002 total population.
[13] City of Lafayette Document, *City of Lafayette Growth Rate*, obtained September 2004.

Based on the assumed rate of growth, the City of Lafayette will reach buildout by 2028. To project water use between 2009 and 2026, water demands were assumed to grow at a rate consistent with population growth. Exhibit K-7 provides projected potable and non-potable demands for the City of Lafayette through 2060.

Exhibit K-7.
Water Demand Projections for the City of Lafayette, in Acre-Feet, 2010 to 2050

Year	Potable	Non-Potable	Total Deliveries	Total Water Requirements
2010	3,900	350	4,200	4,500
2015	4,900	440	5,300	5,800
2020	5,900	530	6,400	7,000
2025	7,000	620	7,600	8,200
2030	7,400	660	8,000	8,700
2035	7,400	660	8,000	8,700
2040	7,400	660	8,000	8,700
2045	7,400	660	8,000	8,700
2050	7,400	660	8,000	8,700
2055	7,400	660	8,000	8,700
2060	7,400	660	8,000	8,700

Source: Harvey Economics, 2010.

An additional 8 percent was added to all potable demands to account for conveyance, treatment and distribution losses. Total water requirements are projected to increase by 93 percent between 2010 and buildout in 2026.

Conservation

The 2009 City of Lafayette Water Conservation Plan (updated in April 2010) supersedes the previous plan prepared in 1997. The goals in this plan are to reduce annual water consumption by 507 AF per year and reduce system-wide water losses to 5 percent (for a savings of 233 AF per year). Since the drought and water shortages of 1976, the City has developed a comprehensive water conservation program that includes:

- A tiered water rate structure introduced in 1981;
- Supply and demand management;
- The development review process;
- Water-wise landscape construction and maintenance practices; and
- Public education

The 2009 plan continues or expands the current programs and introduces several new measures. The new measures include:

- verifying that actual irrigation use in new developments is consistent with projected (efficient) irrigation use (enforcing Municipal Code Section 26-19-5);
- irrigation system upgrades;
- improved water accounting and system-wide leak detection;
- fixture replacement;
- rate structure changes to billing system; and
- water-efficient commercial processes.

To demonstrate that these measures are effective, Lafayette will accumulate data, analyze trends between demand and conservation measures, evaluate the effectiveness of individual conservation programs, and share this information with the public through the Public Works Department web pages. The plan will be revised again in 2016.

APPENDIX L
LEFT HAND WATER DISTRICT
Water Demands

The Left Hand Water District (LHWD) is responsible for providing potable water to residential, commercial and industrial users within Boulder and Weld Counties. In 2009, the District provided service to about 6,300 taps within a service area that is approximately 135 square miles, bound by the foothills to the west, Boulder and Erie to the south, Longmont to the north, and I-25 to the east.[1] Supplies are treated and delivered through the Spurgeon and Alva Dodd filtration facilities.

Historical Water Demands

LHWD's 2009 service area population was estimated at 18,700 persons. Exhibit L-1 provides historical population and number of tap estimates along with annual growth rates for each.

Exhibit L-1.
Total Population and Total Number of Taps for LHWD, 1990 to 2009

	Population		Taps	
Year	Total	Annual Percent Change	Total	Annual Percent Change
1990	10,815	N.A.	3,540	N.A.
1991	11,403	5.4%	3,733	5.5%
1992	11,834	3.8%	3,879	3.9%
1993	13,178	11.4%	4,316	11.3%
1994	14,364	9.0%	4,708	9.1%
1995	15,044	4.7%	4,924	4.6%
1996	15,132	0.6%	4,994	1.4%
1997	15,424	1.9%	5,088	1.9%
1998	15,654	1.5%	5,174	1.7%
1999	15,733	0.5%	5,214	0.8%
2000	16,000	1.7%	5,306	1.8%
2001	16,268	1.7%	5,391	1.6%
2002	16,321	0.3%	5,526	2.5%
2003	16,990	4.1%	5,707	3.3%
2004	17,369	2.2%	5,806	1.7%
2005	17,925	3.2%	5,963	2.7%
2006	18,506	3.2%	6,131	2.8%
2007	18,536	0.2%	6,267	2.2%
2008	18,565	0.2%	6,307	0.6%
2009	18,678	0.6%	6,347	0.6%

Source: LHWD document, "Billed Usage," obtained November 2004; US Census Bureau; LHWD, 2010 Harvey Economics, 2010.

[1] NCWCD Document, NISP Questionnaire, obtained March 2010.

Over the 1990 to 2009 period, the service area population grew at an average annual rate of 2.9 percent, or by about 7,900 people. Annual growth rates for both population and the number of taps peaked in the early 1990s and have averaged 1.6 percent, or 260 people, per year since 1995.

Potable water demands. Exhibit L-2 provides a breakdown of LHWD's historical potable water use by consumer type for the period 1990 to 2009.

Exhibit L-2.
Potable Water Use by Customer Type,
in Millions of Gallons, 1990 to 2009

Year	Residential	Non-Residential	Total
1990	927	163	1,090
1991	857	170	1,026
1992	672	173	844
1993	657	183	840
1994	765	188	953
1995	807	187	994
1996	818	188	1,006
1997	851	122	974
1998	997	131	1,129
1999	940	143	1,083
2000	1,171	157	1,329
2001	1,153	156	1,309
2002	1,025	158	1,183
2003	963	141	1,104
2004	846	158	1,004
2005	981	179	1,160
2006	1,126	242	1,369
2007	1,028	272	1,300
2008	1,037	269	1,306
2009	898	212	1,109

Source: LHWD document, "Billed Usage," obtained November 2004;
Interview with Connie Freedman, LHWD, November 2004; and LHWD, 2010.

These figures reflect potable water deliveries to the end user for customers within LHWD. Total potable water deliveries increased by 216 million gallons, or by almost 20 percent between 1990 and 2008.[2] Since 1990, residential users have accounted for about 84 percent of all deliveries. Since 2007, that number has fallen to about 80 percent. LHWD does not have any unusually large water customers.

Exhibit L-3 provides total and residential gallons per capita and per tap per day for 1990 to 2009.

[2] Rainfall in 2009 was unusually high and thus was not used to measure the change over time.

Exhibit L-3.
Potable Water Gallons per Capita per Day and per Tap per Day for LHWD, 1990 to 2009

	GPCD		
Year	Residential	Total	GPTD
1990	237	278	844
1991	209	250	753
1992	158	198	596
1993	140	179	533
1994	151	188	554
1995	153	189	553
1996	153	189	552
1997	157	180	524
1998	177	200	598
1999	153	176	569
2000	188	213	686
2001	182	207	665
2002	159	183	586
2003	145	167	530
2004	133	158	474
2005	150	177	533
2006	167	203	612
2007	152	192	568
2008	153	193	567
2009	132	163	479

Source: Based on data presented in Exhibits L-1 and L-2.

Over the past ten years, residential and total per capita per day use and total per tap per day use averaged 162, 194 and 589 gallons, respectively.

Non-potable water demands. LHWD does not supply non-potable water. LHWD uses approximately 300 of its Left Hand Ditch Company shares for irrigation of its rural properties. This water and its use were not deemed relevant to this study, as the District does not consider this water in its daily operations or for planning purposes.

Total water requirements. Exhibit L-4 indicates total water requirements for LHWD from 1990 through 2009.

Exhibit L-4.
Total Water Requirements for LHWD, in Acre-Feet, 1900 to 2009

Year	Total Deliveries	Total Water Requirements
1990	3,346	3,888
1991	3,150	3,659
1992	2,591	3,010
1993	2,577	2,994
1994	2,923	3,397
1995	3,049	3,542
1996	3,086	3,586
1997	2,988	3,471
1998	3,463	4,023
1999	3,323	3,861
2000	4,077	4,737
2001	4,015	4,665
2002	3,630	4,217
2003	3,387	3,936
2004	3,081	3,579
2005	3,559	4,134
2006	4,200	4,879
2007	3,991	4,636
2008	4,008	4,656
2009	3,404	3,955

Source: LHWD document, "Billed Usage by Category" obtained November 2004 and March 2010; Interview with Connie Freedman, LHWD, November 2004; Interview with Hank Schmidt, LHWD, May, 2010; Harvey Economics, 2010.

Total water requirements reflect an adjustment made to account for conveyance and treatment losses that occur prior to delivery. Total water requirements have increased from 3,888 acre-feet in 1990 to 4,565 acre-feet in 2008, a gain of 769 acre-feet, or about 20 percent. Water requirements in 2009 were low due to unusually and timely high rainfall.

Projected Water Requirements

LHWD provided the study team with projected numbers of tap equivalents. These projections were prepared by Integra Engineering for the Left Hand Water District *2006-2007 Treated Water Master Plan*. Residential tap equivalents (RTE's) were projected for 5, 10, and 20 year scenarios as well as for buildout. The Integra Engineering projections are provided in Exhibit L-5. However, the *2008 Water Conservation Plan*[3] estimates the total RTE's at buildout to be 15,559.5. The study team chose to use 15,500 as the number of RTE's at buildout.

[3] Clear Water Solutions Inc. *Left Hand Water District Water Conservation Plan*, July 2008.

Exhibit L-5.
Projected Number of Tap Equivalents for LHWD from the 2006-2007 Treated Water Master Plan

Scenario	Additional TE's	Total TE's	Avg. Day Demand (mgd)	Max. Day Demand (mgd)	Peak Hour Demand (mgd)
Existing	N/A	6,591	4.27	11.96	21.35
5-Year	2,000.50	8,591.50	5.57	15.58	27.83
10-Year	1,156	9,747.50	6.32	17.69	31.58
20-Year	3,650.50	13,398	8.68	24.31	39.07
Build-out	1,665.50	15,063.50	9.76	27.33	43.93

Source: Integra Engineering, *Left Hand Water District 2006-2007 Treated Water Master Plan*, Table 1-2 p.7, March 2009.

To arrive at annual projections of RTE water taps between now and buildout, the study team projected the total number of RTE's based on an annual rate of growth of 3.1 percent. This growth rate mirrors LHWD's growth from 1990 through 2009. Exhibit L-6 presents the study team's projected number of residential tap equivalents through 2060.

Exhibit L-6.
Projected Number of Residential Tap Equivalents for LHWD, 2010 to 2060

Year	RTE
2010	7,100
2015	8,200
2020	9,600
2025	11,200
2030	13,100
2035	15,200
2040	15,500
2045	15,500
2050	15,500
2055	15,500
2060	15,500

Source: LHWD document, "LHWD Water Billed Usage by Category: LHWD," July 2010; Harvey Economics, 2010.

Based on the assumed rate of growth, LHWD will reach buildout by 2040. To project water use between 2010 and 2060, the Study Team multiplied the number of RTE's by the District's historical average of 0.66 AF/year, or 589 gptd. Exhibit L-7 provides projected potable demands for the LHWD through 2060.

Exhibit L-7.
Projected Water Requirements for the LHWD,
in Millions of Gallons and Acre-Feet, 2010 to 2060

	Total Deliveries		Total Water Requirements
Year	MG	AF	AF
2010	1,500	4,700	5,400
2015	1,800	5,400	6,300
2020	2,100	6,300	7,400
2025	2,400	7,400	8,600
2030	2,800	8,600	10,000
2035	3,300	10,000	11,700
2040	3,300	10,200	11,900
2045	3,300	10,200	11,900
2050	3,300	10,200	11,900
2055	3,300	10,200	11,900
2060	3,300	10,200	11,900

Source: Harvey Economics, 2010.

Total deliveries were adjusted to reflect distribution losses of almost 5 percent and conveyance losses of just under 9 percent.[4] Between 2010 and buildout, total water requirements are projected to increase by 5,300 acre-feet, or at an average annual rate of 2.7 percent.

Conservation

In their 1996 Water Conservation Plan LHWD adopted a number of measures to "promote water conservation by education, example, and demonstration." The District's most significant conservation measure has been its aggressive leak detection and repair program. This program has reduced conveyance losses from almost 20 percent to about 9 percent. Other successful measures include a demonstration xeriscape garden, gardening classes, and public education.

The goal of the 2008 Water Conservation Plan is to reduce overall water use by 10.6 percent (714 AF per year). The following programs were either added or expanded in the 2008 WCP:

- Improved Leak Detection & Repair Program;
- Installing meters in the distribution system to pinpoint leak areas;
- Landscape & Irrigation system standards for new development;
- Soil amendment ordinance for new landscapes;
- Restrictive covenants ordinance;
- Requiring wind and rain sensors for commercial and open space irrigation;
- Irrigation system audit & improvements for existing irrigation taps;
- Public education - improvement to website in addition to existing bill stuffers and annual newsletter;

[4] Telephone interview with Hank Schmidt, LHWD, June, 2010

- Children's water festivals;
- Post commercial BMPs on website or as bill stuffers;
- Send ET irrigation scheduling in water bill, website and spring newsletter;
- Residential audit;
- Rebate for low-flow toilets, faucets, and high efficiency clothes washers;
- Rebate for wind and rain sensors for residential customers;
- Rebate for ET (SMART) sprinkler system controllers; and
- Commercial and Industrial water audits.

APPENDIX M
MORGAN COUNTY QUALITY WATER DISTRICT
Water Demands

Morgan County Quality Water District (MCQWD) is responsible for providing water to residential, commercial and industrial users within the District's boundaries in Morgan County, which excludes the City of Fort Morgan. Several large dairies are the District's largest water users. Leprino Foods was one of the largest customers of the District, but in 2006, the City of Fort Morgan began providing water to the Leprino facility. Excel beef is also a former customer of MCQWD; Excel switched to Fort Morgan in 1998. In 2006, MCQWD began water service to the Village of Log Lane and in 2007 they began service to Hillrose. Both are statutory towns in Morgan County.

A portion of MCQWD's service area is outside the Northern Colorado Water Conservancy District's boundaries, and any water demands in this area cannot be served by NISP water. The study team has thus excluded these demands, both historic and projected, from the following analysis.[1]

Historical Water Demands

MCQWD's 2009 service area population was about 6,700 persons.[2] Exhibit M-1 provides historical population estimates and total water taps from 1990 through 2009.

[1] Val Flory, Northern Colorado Water Conservancy District, and Mark Kokes, MCQWD, telephone interviews, October 2004.

[2] Population estimates for the District are based on the number of taps and 2.8 persons per household from the US Census Bureau for Morgan County in 2000.

Exhibit M-1.
MCQWD Service Area Population and Water Tap Change, 1990 through 2009

Year	Population	Total Taps	Annual Change (Taps)	Annual Percent Change
1990	3,037	1,085	N.A.	N.A.
1991	3,190	1,139	55	5.0%
1992	3,288	1,174	35	3.1%
1993	3,460	1,236	61	5.2%
1994	3,729	1,332	96	7.8%
1995	3,911	1,397	65	4.9%
1996	4,078	1,456	60	4.3%
1997	4,276	1,527	71	4.9%
1998	4,532	1,618	91	6.0%
1999	4,735	1,691	72	4.5%
2000	4,973	1,776	85	5.0%
2001	5,148	1,838	62	3.5%
2002	5,484	1,959	120	6.5%
2003	5,709	2,039	80	4.1%
2004	5,986	2,138	99	4.9%
2005	6,249	2,232	94	4.4%
2006	6,388	2,281	50	2.2%
2007	6,519	2,328	47	2.1%
2008	6,584	2,351	23	1.0%
2009	6,653	2,376	25	1.1%

Source: Tap data from MCQWD, May, 2010. Population derived from 2.8 persons per tap, from US Census Bureau 2000, Morgan County.

Over this period water taps grew at an average annual rate of 4.2 percent, or 68 taps per year, but the annual growth rate has fluctuated in a range from one to nearly eight percent. Growth slowed in 2008 and 2009 to about one percent per year.

Potable water demands. Exhibit M-2 provides a breakdown of historical potable water use by consumer type, including large users, for the period 1990 to 2009.

Exhibit M-2.
Potable Water Use by Customer Type for MCQWD, in Millions of Gallons, 1990 to 2009

Year	Residential and Commercial	Leprino & Excel	Large Dairies	Total	Annual Percent Change
1990	219	22	44	284	N.A.
1991	214	5	47	266	-6.3%
1992	215	18	45	278	4.4%
1993	220	22	52	294	5.6%
1994	142	116	74	332	13.1%
1995	233	124	68	425	28.0%
1996	253	140	72	465	9.4%
1997	294	130	73	498	7.1%
1998	320	98	80	498	0.0%
1999	310	100	81	492	-1.3%
2000	342	106	86	534	8.7%
2001	395	107	76	578	8.2%
2002	366	86	95	547	-5.4%
2003	388	110	95	594	8.6%
2004	326	122	116	564	-5.1%
2005	312	131	137	580	2.9%
2006	316	117	158	591	1.9%
2007	482	2	179	663	12.1%
2008	424	0	214	637	-3.8%
2009	475	0	218	693	8.8%

Source: Data from MCQWD, May, 2010.

These figures reflect potable water deliveries to end users, including large customers and residential and smaller commercial customers within the District. Total MCQWD potable water demands more than doubled from 1990 to 2009; 2009 was the peak year at 693 million gallons. Demand from large dairies in the service area grew by almost 400 percent between 1990 and 2009. In 2009, large dairies accounted for more than 30 percent of total demand. Because of this increased demand from large dairies, demand continued to grow even as residential and commercial demand was relatively flat and sales from Leprino and Excel fell to zero. Total potable water deliveries between 1990 and 2009 increased at an average annual rate of 4.8 percent. In 2008, Log Lane Village used 82 acre-feet of its contracted of amount of 164 acre-feet per year, and is projected to reach full usage in 2060. Hillrose uses about 14 acre-feet of its contracted amount of 23 acre-feet per year and is assumed to reach full usage in 2055.

Exhibit M-3 provides total gallons per capita per day (gpcd) and total gallons per tap per day (gptd) for 1990 to 2009. The first two measurements include the large users, while the second two measurements exclude Leprino, Excel and the large dairies.

Exhibit M-3.
MCQWD's Potable Gallons per Capita and per Tap per Day, 1990 to 2009

Year	Total Water Use Per Capita (gpcd)	Total Water Use Per Total Tap (gptd)	Residential & Commercial (gpcd)	Residential & Commercial (gptd)
1990	257	718	197	553
1991	229	641	184	516
1992	232	649	179	502
1993	232	651	174	488
1994	244	683	104	291
1995	298	833	163	456
1996	312	874	170	476
1997	319	893	189	528
1998	301	843	194	542
1999	284	796	180	503
2000	294	824	188	528
2001	308	862	210	589
2002	273	765	183	512
2003	285	798	186	522
2004	258	723	149	417
2005	254	712	137	384
2006	253	710	136	379
2007	278	780	203	567
2008	265	742	176	493
2009	285	799	196	548

Source: Figures are based on the data presented in Exhibits M-1 and M-2.

Total water use per capita and per tap per day has averaged 273 and 765 gallons, respectively, from 1990 through 2009. Total water use, less large water users, per capita and per tap per day averaged 175 and 549 gallons, respectively, from 1990 through 2009.

Non-potable water demands. MCQWD does not provide any non-potable water to its customers.

Total water requirements. Exhibit M-4 indicates MCQWD's total potable and total water requirements from 1990 through 2009.

Exhibit M-4.
Total Water Requirements for MCQWD, in Millions of Gallons and Acre-Feet, 1990 to 2009

Year	Potable Water Deliveries (MG)	Non-Potable Water Deliveries (MG)	Total Water Deliveries (MG)	Total Water Deliveries (AF)	Total Water Requirements (AF)
1990	284	0	284	873	900
1991	266	0	266	817	843
1992	278	0	278	853	880
1993	294	0	294	901	929
1994	332	0	332	1,019	1,051
1995	425	0	425	1,304	1,344
1996	465	0	465	1,426	1,470
1997	498	0	498	1,527	1,575
1998	498	0	498	1,528	1,576
1999	492	0	492	1,508	1,556
2000	534	0	534	1,639	1,690
2001	578	0	578	1,774	1,830
2002	547	0	547	1,679	1,731
2003	594	0	594	1,823	1,880
2004	564	0	564	1,730	1,784
2005	580	0	580	1,780	1,836
2006	591	0	591	1,813	1,870
2007	663	0	663	2,033	2,097
2008	637	0	637	1,955	2,017
2009	693	0	693	2,127	2,194

Source: Data from MCQWD, May, 2010.

Total water requirements reflect actual production of water from the District's three groundwater well sites. Distribution system losses averaged 1 percent, though well production and delivered water sales figures are affected by accounting conventions that can skew the system loss figures in any given year.[3] From 1990 to 2009, total water requirements increased by about 144 percent, or at an average annual rate of almost 5 percent.

Projected Water Requirements

The Engineering Company's projected water requirements. MCQWD provided the study team with projected total water demands for 2020, which The Engineering Company (TEC) prepared in 2001 for the District's *Water System Master Plan*. These 2020 projections were based on a survey of residents, businesses and developers about where and when new taps might be located within the district by 2020.[4] A map of the location of new taps through 2020 is provided in the study, and the District updated these projections with 350 new taps proposed in new developments after the *Water System Master Plan* was published.[5]

[3] Mark Kokes, General Manager, MCQWD, telephone interview, October 2004.
[4] The Engineering Company, *Water System Master Plan*, Morgan County Quality Water District, February 2001.
[5] Mark Kokes, General Manager, MCQWD, telephone interview, October 2004.

Projected water demands. TEC utilized year 2000 water demands and number of taps combined with additional historical data to determine an average water use per tap 746 gallons per equivalent tap per day (gptd). TEC additionally determined that Leprino Foods used about 300,000 gallons of water per day in 2000, equating to 340 acre-feet per year, the use of which TEC held constant in its projections. With these assumptions and the information from the survey, TEC estimated that existing taps plus 1,300 new taps in the District by 2020 (all areas inside the District, including those areas outside NCWCD's boundaries) would demand 2,875 acre-feet of water, including Leprino's 340 acre-feet. The District added 350 new taps to that projection since the plan was published, plus 350 newly served taps in the Village of Log Lane by 2006, bringing new taps by 2020 to a total of 2,000.[6] The study team estimates that 1,700 of those new taps would locate within NCWCD's boundaries.

The study team evaluated TEC's methodology and found that the methods used to project water demands by 2020 were generally sound, given the apparent availability of data. The study team chose, however, to implement its own projections to incorporate more complete historical and current data.

Study team demand projections. To arrive at water demand projections between now and 2060, the study team first projected growth in the number of total taps in the District. The study team estimated a slow increase in new taps per year until 2018, when growth will remain steady at about 65 new taps each year. These projections of new tap development seem reasonable, given that the average number of new taps put into place each year from 1990 to 2009 was 68, and from 2000 through 2009 was 69. Leprino Foods and Excel Beef were not included in future projections. Exhibit M-5 provides the total tap forecasts used to project MCQWD's future water demands.

Exhibit M-5.
Total Tap Projections for MCQWD, 2010 to 2060

Year	Population	Taps	Annual % Growth
2010	6,700	2,400	N.A.
2015	7,200	2,600	1.4%
2020	7,900	2,800	2.0%
2025	8,700	3,100	1.9%
2030	9,500	3,400	1.7%
2035	10,300	3,700	1.6%
2040	11,000	3,900	1.5%
2045	11,800	4,200	1.4%
2050	12,600	4,500	1.3%
2055	13,400	4,800	1.2%
2060	14,100	5,100	1.1%

Source: Harvey Economics, 2010.

[6] The Engineering Company, *Water System Master Plan*, Morgan County Quality Water District, February 2001, and Mark Kokes, General Manager, MCQWD, telephone interviews, October and November 2004.

The second step in the study team's water demand projections was to apply 0.55 AF per tap per year to residential and commercial taps, based on historic use per tap in the District. These projections include water use by Log Lane Village and Hillrose.

The study team then determined future water demands for the large dairies in MCQWD. Based on discussions with the District, the large dairies' water usage has been increasing since 1990, and MCQWD expects the number of dairies and their water usage to continue to increase into the future. Based on historic trends and discussions with MCQWD, the team assumed a steady growth in large dairies' usage of 2 percent each year from 2010 through 2060. Exhibit M-6 below provides projected potable and non-potable demands for all sectors of MCQWD through 2060.

Exhibit M-6.
Water Demand Projections for MCQWD, 2010 to 2060, in Acre-Feet

Year	Residential and Commercial	Large Dairies	Total Potable	Non-Potable	Total Water Deliveries	Total Water Requirements
2010	1,300	700	2,000	0	2,000	2,100
2015	1,400	800	2,200	0	2,200	2,200
2020	1,500	800	2,400	0	2,400	2,400
2025	1,700	900	2,600	0	2,600	2,700
2030	1,800	1,000	2,900	0	2,900	2,900
2035	2,000	1,100	3,100	0	3,100	3,200
2040	2,100	1,200	3,400	0	3,400	3,500
2045	2,300	1,400	3,700	0	3,700	3,800
2050	2,500	1,500	4,000	0	4,000	4,100
2055	2,600	1,700	4,300	0	4,300	4,400
2060	2,800	1,800	4,600	0	4,600	4,700

Source: Harvey Economics, 2010.

An additional 3 percent was added to all potable demands to account for distribution system losses per the suggestion from the District. Total water requirements will increase from 2,100 acre-feet in 2010 to 2,700 acre-feet by 2025, a gain of 600 acre-feet. By 2060, total water requirements will increase by about 124 percent, or at an average annual rate of 1.6 percent.

Conservation[7]

MCQWD has implemented several measures to encourage conservation throughout its system. The District has an increasing block rate structure for water sales. The highest tier rate is equal to 3 times the next lowest tier rate for usage above the allotted quantity per tap size. The highest tier rate for 2010 is $7.20 per 1,000 gallons.[8] This increase in the cost of water encourages conservation by MCQWD's customers.

[7] Mark Kokes, General Manager, MCQWD, personal interview, September 2004 and response to NISP Questionnaire from Northern Colorado Water Conservancy District, May, 2010.
[8] Response to NISP Questionnaire from Northern Colorado Water Conservancy District, May, 2010.

MCQWD's agricultural customers also conserve water as a matter of course to reduce operational costs.

The District has no other conservation plans in place, but it is in the process of developing a water conservation plan. As part of this plan, the District is considering dual systems for non-potable ditch water usage to irrigate new developments in order to conserve the District's high quality groundwater.

APPENDIX N
TOWN OF SEVERANCE
Water Demand

The Town of Severance, located east of I-25 and northeast of the Town of Windsor, is responsible for providing water to residential and commercial users within its service area. Until 2003, the North Weld County Water District (NWCWD) was responsible for securing supplies necessary to meet demands within the Town of Severance. Due to concerns regarding excessive growth, the NWCWD initiated a process whereby Severance would become responsible for securing the raw water supplies to meet demands within its service boundaries. The Severance water service area boundaries are not coincident with the Town; portions of the Town are served by NWCWD, and the Town's Water Department serves certain areas outside town boundaries.

In order to take over its own water service, Severance installed a 500,000 gallon storage tank and a booster pump in late 2003. Since that time, Severance has been responsible for securing raw water supplies, while NWCWD remains responsible for treating the raw water.

Water supplies utilized by the Town's customers are diverted and treated by NWCWD and delivered to Severance through a master meter. Severance must supply NWCWD with 110 percent of the water delivered to its master meters to account for treatment and delivery losses.

Historical Water Demands

As of 2009, Severance's service area population was about 2,600 persons. This total does not include residents who reside within the Town limits but outside the Town's service area boundaries. Exhibit N-1 provides historical population estimates and total numbers of taps for the period 1990 to 2009.

Exhibit N-1.
Population and Total Water Taps for the Town of Severance, 1990 to 2009

Year	Service Area Population	Annual Percent Change	Number of Taps	Annual Percent Change
1990	89	N.A.	36	N.A.
1991	110	23.9%	45	23.9%
1992	112	1.8%	46	1.8%
1993	114	1.7%	46	1.7%
1994	116	1.7%	47	1.7%
1995	118	1.7%	48	1.7%
1996	178	50.8%	72	50.8%
1997	238	33.7%	97	33.7%
1998	298	25.2%	121	25.2%
1999	358	20.1%	145	20.1%
2000	400	11.9%	163	11.9%
2001	524	30.9%	213	30.9%
2002	793	51.3%	322	51.3%
2003	1,089	37.3%	442	37.3%
2004	1,341	23.2%	557	26.0%
2005	1,747	30.3%	742	33.2%
2006	2,207	26.3%	810	9.2%
2007	2,573	16.6%	907	12.0%
2008	2,645	2.8%	920	1.4%
2009	2,622	-0.9%	962	4.6%

Source: Town of Severance "Severance Housing and Population Projections," obtained July 2010.

Over this period, population grew at an average annual rate of approximately 20 percent, or by a total of about 2,500 persons. Much of this growth occurred from 1996 through 2003, during which time the Town increased in population fivefold. Before 2004, developers were not required to secure the water necessary to meet resulting demands, which may explain some of the Town's rapid growth.[1] However, growth remained strong through 2007, as shown above. As of 2010, developers must provide one unit of C-BT water per dwelling unit or one NPIC share for 3.5 homes.

Potable water demands. Exhibit N-2 provides an historical breakdown of potable water demands between 1995 and 2009 for Severance. Data reported since 2004 reflect deliveries made between September and August each year, defined as Severance's water year and reflecting the time when the Town began keeping track of its own water deliveries. Previous years were reported by NWCWD.

[1] Interview, John Holdren, Town of Severance. September 2004.

Exhibit N-2.
Potable Water Deliveries for the Town of Severance, in Millions of Gallons, 1995 to 2009

	Water Deliveries to End Users (MG)		
Year	Residential	Non-Residential	Total
1995	N.A.	N.A.	9
1996	N.A.	N.A.	16
1997	N.A.	N.A.	18
1998	N.A.	N.A.	24
1999	N.A.	N.A.	27
2000	N.A.	N.A.	34
2001	N.A.	N.A.	33
2002	N.A.	N.A.	30
2003	N.A.	N.A.	42
2004 *	51	2	53
2005 *	N.A.	N.A.	88
2006 *	N.A.	N.A.	115
2007 *	N.A.	N.A.	127
2008 *	N.A.	N.A.	126
2009 *	N.A.	N.A.	111

* Reflects estimated water use for the November to October water year.
Source: Town of Severance document, 2010; Harvey Economics, 2010.

Total water deliveries increased at an average annual rate of about 19 percent, or by 102 million gallons between 1995 and 2009. This growth is consistent with population growth during this period.

The only period for which the Town has tracked deliveries to its customers, by type, was for September 2003 through August 2004. Almost all water use was residential in that year; commercial water use has grown somewhat since with the development of a small retail center near the Town Hall.

Exhibit N-3 reports total potable gallons per capita per day (gpcd).

Exhibit N-3.
Town of Severance Total Gallons per Capita per Day, 1995 to 2009

Year	GPCD
1995	220
1996	242
1997	204
1998	222
1999	210
2000	235
2001	173
2002	105
2003	105
2004	108
2005	137
2006	143
2007	135
2008	130
2009	116

Source: Based on data presented in Exhibits N-1 and N- 2.

Total potable gpcd averaged 166 gallons between 1995 and 2009 and 139 gpcd between 2000 and 2009. Consumption patterns were lower in 2002 and 2003, likely attributable to the impact of drought on consumption. Since that time, gpcd has risen but remains below pre-drought levels.

Non-potable water demands. The Town currently irrigates parks and open space with non-potable water.[2] Total non-potable water requirements as of 2009 were approximately 54 acre-feet.[3]

Total water requirements. Exhibit N-4 provides total historical water requirements for the Town of Severance. In addition to the 10 percent surcharge provided to NWCWD, an additional 5 percent was added to potable water supplies to account for delivery losses incurred between the Town's master meters and the end user.[4]

[2] Interview with John Holdren and Zach Ratkai, Town of Severance, July 2010.
[3] Email from John Holdren, Town Manager, Town of Severance, July 2010.
[4] Interview, John Holdren and Zach Ratkai, Town of Severance. July 2010.

Exhibit N-4.
Total Water Requirements for the Town of Severance, in Millions of Gallons and Acre-Feet, 1995 to 2009

	Total Deliveries		Total Water Requirements
Year	MG	AF	AF
1995	9	29	34
1996	16	48	57
1997	18	54	64
1998	24	74	88
1999	27	84	100
2000	34	106	125
2001	33	102	120
2002	30	93	110
2003	42	128	151
2004 *	53	162	192
2005 *	88	269	318
2006 *	115	353	418
2007 *	127	389	460
2008 *	126	386	456
2009 *	111	341	403

* Reflects estimated water use for the November to October water year.
Source: Town of Severance, 2010; Harvey Economics, 2010.

Total water requirements for the Town of Severance service area have increased from 34 acre-feet in 1995 to 403 acre-feet in 2009, a more than tenfold increase.

Projected Water Demands

The Town of Severance provided the study team with population forecasts through 2025. To arrive at the projected number of residents, the Town forecasted number of dwelling units based on various annual growth rate scenarios. Average household size in these projections was 3.2 persons per household (pph) for 2010, gradually declining to 2.5 pph in 2025.

The study team evaluated the methodology utilized by the Town of Severance to forecast population and found it to be acceptable. The Town uses the 10 percent growth rate for planning purposes. After reviewing historic growth within Weld County and the Town, plus considering its small size, the study team determined that the projections based on 10 percent growth were appropriate through 2030, when the Town will reach buildout.

To arrive at projected water demands, the study team first adjusted the population forecasts to reflect differences between the Town's city limits and its service area. Assuming no changes in the current service area boundaries, the Town estimates service area population at buildout to be 15,000 persons.[5] Exhibit N-5 presents revised population and tap projections for the Town of Severance service area through 2060.

[5] Interview with John Holdren and Zach Ratkai, Town of Severance, July 2010.

Exhibit N-5.
Population and Tap Projections for the Town of Severance Service Area, 2010 to 2060

	Population		Number of Taps	
Year	Total	Average Annual Percent Change	Total	Average Annual Percent Change
2010	2,900	N.A.	1,100	N.A.
2015	4,600	10%	1,700	9%
2020	7,500	10%	2,700	10%
2025	12,000	10%	4,400	10%
2030	15,000	5%	5,500	5%
2035	15,000	0%	5,500	0%
2040	15,000	0%	5,500	0%
2045	15,000	0%	5,500	0%
2050	15,000	0%	5,500	0%
2055	15,000	0%	5,500	0%
2060	15,000	0%	5,500	0%

Source: Town of Severance document, "Severance Housing and Population Projections," obtained July, 2010; Harvey Economics, 2010.

Based on the assumed rate of growth, the service area for the Town of Severance will reach buildout by 2030. HE applied the long term historical average 166 gpcd to the population projections; the same figure Severance uses for planning purposes. Exhibit N-6 provides projected water demands for the Town of Severance through 2060.

Exhibit N-6.
Water Demand Projections for the Town of Severance, in Millions of Gallons and Acre-Feet, 2010 to 2060

	Potable	Non-Potable	Total Deliveries		Water Requirements
Year	(MG)	(MG)	(MG)	(AF)	(AF)
2010	170	26	200	610	700
2015	280	42	320	980	1,200
2020	450	68	520	1,600	1,900
2025	730	109	840	2,600	3,100
2030	910	136	1,050	3,200	3,800
2035	910	136	1,050	3,200	3,800
2040	910	136	1,050	3,200	3,800
2045	910	136	1,050	3,200	3,800
2050	910	136	1,050	3,200	3,800
2055	910	136	1,050	3,200	3,800
2060	910	136	1,050	3,200	3,800

Source: Harvey Economics, 2010.

Non-potable demand is assumed to grow at a rate consistent with population. In addition to the losses charged by NWCWD for its treatment and delivery to Severance's master meters, 5 percent was added to all potable demands to account for distribution losses between the master meter and end user. Total water requirements are expected to increase to 3,800 acre-feet for the Town of Severance by 2030.

Conservation

The Town of Severance has implemented several measures to encourage conservation. The Town currently utilizes an increasing block rate structure to promote efficient use. Severance maintains permanent water restrictions that limit the days and times of days that customers can water outdoors. The Town also provides educational materials relating to efficient water use.

APPENDIX O
TOWN OF WINDSOR
Water Demands

The Town of Windsor was founded in 1882 as an agricultural center in the Cache LaPoudre River Valley. Much of the Town's early growth was attributable to sugar beet production and processing which ended in the mid 1960s. Growth resumed during the 1970s with the development of the Kodak Colorado Division facility near Windsor. Rapid growth ensued again during the 1990s as development occurred along the I-25 corridor between Denver and Cheyenne. Windsor is located east of Interstate 25, west of Greeley, and east of Loveland and Fort Collins.

The Town of Windsor serves residential, commercial, industrial and public water users within the Town, plus a very small number of water users outside the city limits, but in close proximity. The Town of Windsor water supplies are distinguished from other communities of its size in that outside entities treat and deliver to master meters almost all of the water that Windsor delivers. Fort Collins-Loveland Water District, the City of Greeley and North Weld County Water District all supply treated water to Windsor, requiring that Windsor contribute between 110 percent and 130 percent of its raw water needs to the respective supplier.[1] Windsor also operates a well-developed residential and commercial dual water system in which certain developments provide their own irrigation water, relying on lakes and ditch water. The goal is that much of the future irrigation requirements in the community will be met through this dual water system.

Historical Water Demands

As of 2009, population for the Town of Windsor is estimated to be 19,265 persons. Exhibit O-1 provides the historical population and water tap growth for the Town of Windsor, from 1990 through 2009.

[1] Interview with Dennis Wagner, Director of Engineering, Town of Windsor, October 2004.

Exhibit O-1.
Town of Windsor Population and Water Taps, 1990 through 2009

Year	Population	Taps
1990	5,062	1,552
1991	5,162	1,616
1992	5,292	1,670
1993	5,550	1,740
1994	5,874	1,885
1995	6,288	2,100
1996	6,897	2,259
1997	7,371	2,463
1998	8,082	2,800
1999	9,115	3,100
2000	10,873	3,460
2001	12,162	3,654
2002	13,136	3,948
2003	14,061	4,030
2004	15,317	4,084
2005	16,677	4,226
2006	18,052	4,384
2007	18,670	4,536
2008	19,001	4,740
2009	19,265	4,937

Sources: DOLA, Demography Section, November 2004; Town of Windsor response to NISP Questionnaire from Northern Colorado Water Conservancy District, May, 2010.

Windsor population has grown by 281 percent from 1990 through 2009, for an average annual rate of 7.3 percent. This substantial growth is attributable to Windsor's emergence as a bedroom community for the larger communities nearby and a service center for those residents. Total water taps served by the Town of Windsor tripled from 1990 to 2009; as of August 2009 there were a total of 4,937 water taps served by the Town. In 2007, approximately 94 percent of the water taps were for residential water users, either indoor or on dual water systems.[2]

Potable water demands. Total potable water demands from 1990 through 2009 are provided in Exhibit O-2.

[2] Clear Water Solutions. *Town of Windsor 2008 Water Conservation Plan*.

Exhibit O-2.
Total Potable Water Use for the Town of Windsor, in Millions of Gallons, 1990 through 2009

Year	Total Potable Water Deliveries (MG)
1990	281
1991	307
1992	283
1993	271
1994	287
1995	319
1996	362
1997	378
1998	444
1999	457
2000	516
2001	573
2002	576
2003	502
2004	496
2005	561
2006	622
2007	630
2008	579
2009	524

Source: Town of Windsor document provided by Dennis Wagner, October 2004. Town of Windsor response to NISP Questionnaire from Northern Colorado Water Conservancy District, May 2010.

Total water deliveries to Town of Windsor customers were estimated from water purchases at master meters from Windsor's suppliers, plus 9 percent, to account for distribution losses.[3] Water deliveries doubled from 1990 through 2007, the peak year, when 630 million gallons were sold. Water deliveries fluctuated with drought conditions in the early years of the 2000s; 2003and 2004 experienced a significant drop due to drought related restrictions. In 2009, total potable water deliveries dropped to 524 million gallons, due to a higher than average amount of timely precipitation.

Since 2004, Town of Windsor has compiled records on water sales by type of user. Water use by customer type for 2009 is shown in Exhibit O-3.

[3] Town of Windsor response to NISP Questionnaire from Northern Colorado Water Conservancy District, May, 2010.

Exhibit O-3.
Town of Windsor Water Use by Customer Type, in Millions of Gallons, 2009

Type of Customer	Total Water Deliveries (MG)	Percent of Total
Residential, non-dual system	275.8	52.6%
Residential, with dual water system	92.8	17.7%
Commercial	41.6	7.9%
Industrial	63.6	12.1%
Commercial with dual system	4.1	0.8%
Public	8.5	1.6%
Landscape uses only	38.1	7.3%
Totals	**524.4**	**100%**

Source: Document provided by Town of Windsor, obtained May 2010.

Total residential water use accounts for just over 70 percent of total use by the Town of Windsor. Customers with dual water systems account for over 18 percent of total water use; these customers rely on other water resources for their irrigation needs.

Industrial use accounts for more than 12 percent of total Windsor water use. Three larger industrial water users include the Vestas wind turbine plant, which was constructed in 2007, Metal Container, and an Owens-Illinois bottling plant. These large users' water use rates are expected to remain steady.[4] Historical water consumption data for specific industrial customers were unavailable. Even so, it is clear that Windsor has a long term history of attracting industry and relatively large employers to its area.

Exhibit O-4 provides the total gallons per capita per day (gpcd) and total gallons per tap per day (gptd) for the Town of Windsor, from 1990 through 2009.

[4] Interviews with representatives for Metal Container Corporation, Owens-Illinois, and Vestas Wind Turbines, April 2010.

Exhibit O-4.
Gallons per Capita and per Tap per Day for the Town of Windsor, 1990 through 2009

Year	Gallons per Capita per Day	Gallons per Tap per Day
1990	152	496
1991	163	521
1992	147	465
1993	134	427
1994	134	418
1995	139	417
1996	144	439
1997	141	421
1998	151	435
1999	137	404
2000	130	408
2001	129	430
2002	120	400
2003	98	341
2004	89	333
2005	92	364
2006	94	388
2007	92	380
2008	83	335
2009	75	291

Source: From data provided in Exhibits O-1 and O- 2.

Average gpcd over this period amounted to 122, and average gptd was 406. The average gpcd from 1999 to 2009 was 104 while the gptd was 370. These reductions are likely due to both increased conservation efforts and the introduction of mandatory dual use water systems in the early 2000s.

Non-potable water demands. Referred to in the Town of Windsor as dual water systems, non-potable water use is prevalent for both residential and commercial water users. The Town of Windsor recognized the pending stress on its water supplies as growth accelerated during the 1990s. As new developments came into the community, a requirement for dual water systems was established in the early 2000s. The Town of Windsor continues to supply and track potable water demands from these customers, but those dual water customers are responsible for providing their own irrigation water through lakes and ditch systems. No separate records are available for those requirements and they are therefore excluded from historical and future water consumption estimates.

Total water requirements. Exhibit O-5 indicates total water requirements for the Town of Windsor from 1990 through 2009.

Exhibit O-5.
Total Water Requirements for the Town of Windsor, 1990 through 2009

Year	Total Water Deliveries (MG)	Total Water Deliveries (AF)	Total Water Requirements (AF)
1990	281	863	1,142
1991	307	943	1,249
1992	283	869	1,151
1993	271	831	1,101
1994	287	882	1,168
1995	319	980	1,298
1996	362	1,112	1,472
1997	378	1,161	1,537
1998	444	1,364	1,805
1999	457	1,402	1,856
2000	516	1,582	2,095
2001	573	1,760	2,330
2002	576	1,768	2,341
2003	502	1,541	2,040
2004	496	1,522	2,015
2005	561	1,723	2,281
2006	622	1,907	2,525
2007	630	1,933	2,559
2008	579	1,776	2,352
2009	524	1,609	2,131

Source: Town of Windsor response to NISP Questionnaire from Northern Colorado Water Conservancy District, May 2010; and Interview with Dennis Wagner, Director of Engineering, Town of Windsor, October 2004.

Total water deliveries are adjusted 9 percent to account for distribution losses within the Town of Windsor system, plus 17 percent, which is the weighted average water resource charge from Windsor's three treated water suppliers. Total water requirements peaked in 2007 at 2,559 acre-feet, an increase of 1,416 acre-feet, or 124 percent from 1990. Average annual growth in the Town of Windsor's water requirements from 1990 through 2009 was 3.3 percent.

Projected Water Requirements

Town of Windsor demand projections. The Town of Windsor prepared water demand projections based upon assumptions developed as part of its *Potable Water Master Plan* 2009.[5] In this *Potable Water Master Plan*, the land use area plan from Windsor's 2006 comprehensive plan is used to project future water demand. The land use plan shows the amount of land classified as residential, commercial, etc. at buildout. Each of the 14 classifications was multiplied by an average water use per acre to project water use at buildout. The Town also projected the number of acres that would be served by non-potable water and subtracted these from the relevant classification total. The 2009 Potable Water Master Plan projects that Windsor will demand 12,542 AF water at buildout, but does not predict when buildout will be reached. The 2006 Update of the 2002 Comprehensive Plan

[5] Clear Water Solutions, *Town of Windsor Potable Water Master Plan*, November 2009.

projects that Windsor will reach buildout between 2085 and 2095[6]. Exhibit O-6 shows the future potable water demands for Windsor, broken down by land use classification.

Exhibit O-6.
Water Demand Projections Prepared by the Town of Windsor, in Acre-Feet, at buildout

WINDSOR WATER SERVICE AREA					POTABLE DEMAND			
CODE	DESCRIPTION	Windsor Gross Acres	Windsor Net Acres	No. of homes	Indoor (ac-ft)	No of Irrigated Acres	Outdoor (ac-ft)	Total (ac-ft)
MFR	Multi-Family Residential	88	84	1,232	188	13	19	207
E-1	Low Density Estate Single Family Residential	881	793	317	80	58	11	90
E-2	High Density Estate Single Family Residential	3,179	2,702	3,973	998	547	62	1,059
RMU	Residential Mixed Use	3,330	2,831	15,984	4,251	1,101	884	5,135
SFR	Single Family Residential	2,760	2,484	11,040	2,772	1,014	636	3,408
SCHL	Schools	98			65			65
POSF	Parks, Open Space, Mineral Extraction & Flood Plain	2,745						
CS	Community Separator	1,837						
CBD	Central Business District	43	32		15	5	11	26
NGC	Neighborhood & General Commercial	810	608		289	91	210	499
OPUB	Other Public/Semi-Private	45	34		16	5	12	28
I-L	Light Industrial	1,174	880		547	132	304	851
I-H	Heavy Industrial	1,089	817		508	123	282	790
EC	Employment Corridor	620	465		222	47	161	382
	TOTAL	**18,698**	**11,728**	**32,547**	**9,952**	**3,135**	**2,590**	**12,542**

Source: Town of Windsor, *Potable Water Master Plan*, November 2009, Table 3.3, Page 12.

The study team evaluated the Town of Windsor projections and supports the methodology of average water use per acre multiplied by land use projections for different classifications of land. However, this method only provides projected water demand at buildout, with no information about water demands in the intervening years. The study team, therefore, found it necessary to project water demands using a method that provided results on an annual basis.

Study team projections. For the purpose of projecting residential water use, the study team assumed 2 percent population growth each year until 2030 and then 3 percent growth until 2060.[7] The Town is using 2 percent growth for its planning period which ends in 2030. The Study Team believes that more rapid growth is likely and therefore utilized a 3 percent growth rate from 2030 to 2060. Population projections from 2010 to 2060 are provided in Exhibit O-7.

[6] Town of Windsor, *2006 Update of the 2002 Comprehensive Plan*, January 2007, page 40.
[7] Town of Windsor response to NISP Questionnaire from Northern Colorado Water Conservancy District, May, 2010.

Exhibit O-7.
Population Projections for the Town of Windsor, 2010 through 2060

Year	Population
2010	19,700
2015	21,700
2020	24,000
2025	26,400
2030	29,200
2035	33,900
2040	39,200
2045	45,500
2050	52,700
2055	61,100
2060	70,900

Source: Harvey Economics, 2010.

The study team used a water demand forecasting methodology that incorporates the demand for both the older, potable only water users and the newer dual use system users. The potable only users are assumed to maintain their higher gpcd of 131, whereas all new users are assumed to be on a dual use system and are assigned the newer, lower gpcd of 109. Exhibit O-8 depicts the study team's water demand projections for the Town of Windsor through the year 2060.

Exhibit O-8.
Study Team Water Demand Projections for the Town of Windsor, 2010 through 2060

Year	Total Water Deliveries (MG)	Total Water Deliveries (AF)	Total Water Requirements (AF)
2010	600	1,850	2,400
2015	680	2,090	2,900
2020	760	2,330	3,200
2025	860	2,640	3,600
2030	960	2,950	4,100
2035	1,140	3,500	4,800
2040	1,340	4,110	5,700
2045	1,580	4,850	6,700
2050	1,850	5,680	7,800
2055	2,170	6,660	9,200
2060	2,540	7,790	10,700

Source: Harvey Economics, 2010.

Non-potable water demands are excluded from these figures since the Town's dual use system has no involvement with those water requirements. Total water deliveries are adjusted by 9 percent distribution losses and a weighted average 17 percent water resource charge exacted by the Town of Windsor's treated water providers. Total water requirements for the Town of Windsor are expected to increase from 2,400 acre-feet in 2010 to 11,200 acre-feet in

2060. This represents a total increase in water demand of 8,800 acre-feet, or 367 percent over 2009 requirements.

Conservation

Prior to the 2008 Water Conservation Plan (WCP), the Town of Windsor had implemented the following conservation programs:

- Public information including, bill stuffers, ads in the newspaper, etc.;
- Lawn watering restrictions between 10 a.m. and 6 p.m. each day;
- A regular leak detection system;
- Town plumbing codes that require low flow water appliances be installed;
- Landscaping restrictions as to amount of developed area;
- Car washing guidelines;
- An inclining block rate structure based upon a water budget, plus a surcharge for excess water use; and
- A policy of requiring dual water systems for new development where possible using ditch water provided by the developer or water user.

Water savings as a result of these programs is uncertain, but the Town intends to attempt to measure future conservation savings.

The overall water conservation goal from the 2008 WCP is a twelve percent reduction. This goal will be accomplished through the following additional programs:

- Non‐potable park well meters
- Leak detection & repair
- Water rate changes
- Regulatory standards programs
    - Irrigation system standards for new development
    - Requiring wind and/or rain sensors for business and open space irrigation
    - New car wash standards (new construction)
- Audit programs
    - Residential water audit kits
    - Business and industrial water audits
- Educational programs
    - Xeriscape demonstration garden
    - Website water use calculator

    - Send evapotranspiration irrigation scheduling in water bill
    - Public education – bill stuffers & website
    - Post business, industrial, and public bmps on website or as bill stuffer
- Rebate program
    - Irrigation system efficiency device rebates
- Meter testing and replacement

Appendix P
NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form Water Supplier:**Central Weld County Water District** Updated: 9/01/09						
Water Right Name	**No. of shares or Units Owned**	**Avg. Annual Yield (af/sh)**	**Annual Yield (af)**	**Firm or Dry Yr. Annual Yield (af/sh)**	**Firm Annual Yield (af)**	**Notes and Comments**
Transbasin Sources						
CBT Project						
Total units owned	5221					
Variable quota	5221	0.7	3654.7	0.6	3132.6	According to the cap calculation the firm annual yield is 0.5 for C-BT
Fixed quota	0	0.7	0.0	0.6	0.0	
Windy Gap Project						
Units owned	1	60.0	60.0	0.0	0.0	According to the cap calculations the average and firm yields of Windy Gap water are 50
Water Transfered by Towns			7100.0		7100.0	Dacono, Firestone, Fredrick, Kersey, Milliken, LaSalle, Gilcrest, Platteville, Aristrocrat Ranchette and portions of Left Hand Water District
Mutual Irrigation Company Ownership						
Greeley Loveland	0.33	24.00	7.9	12.0	4.0	
Total without Transfers			3722.6		3136.6	
Total			10822.6		10236.6	

Appendix P
NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form Water Supplier: **Town of Dacono** Updated: 10/01/10						
Water Right Name	**No. of shares or Units Owned**	**Avg. Annual Yield (af/sh)**	**Annual Yield (af)**	**Firm or Dry Yr. Annual Yield (af/sh)**	**Firm Annual Yield (af)**	**Notes and Comments**
Transbasin Sources						
CBT Project						
Total units owned	1772					
Variable quota	1772	0.7	1240.4	0.6	1063.2	
Fixed quota						
Total			1240.4		1063.2	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form Water Supplier: **Eaton** Updated: 3/16/2010						
Water Right Name	**No. of shares or Units Owned**	**Avg. Annual Yield (af/sh)**	**Annual Yield (af)**	**Firm or Dry Yr. Annual Yield (af/sh)**	**Firm Annual Yield (af)**	**Notes and Comments**
Direct flow sources						
Wells			644.0		644.0	All future non-potable demands can be met with wells (figure shown is build-out non-potable demand)
Transbasin Sources						
CBT Project						
Total units owned	976					
Variable quota	976	0.7	683.2	0.6	585.6	
Fixed quota						
Mutual Irrigation Company Ownership						
NPIC (CBT Portion)	171	2.8	478.8	2.4	410.4	
NPIC (Native portion)	171	2.4	410.4	1.2	205.2	Not currently available for Municipal use and not included in total.
Windsor Reservoir Co.	1		25.0		10	For use in dual system
Larimer and Weld Canal	1		20.0		0	
Total			1831.0		1650.0	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form Water Supplier: **City of Evans** Updated: 12/30/09						
Water Right Name	**No. of shares or Units Owned**	**Avg. Annual Yield (af/sh)**	**Annual Yield (af)**	**Firm or Dry Yr. Annual Yield (af/sh)**	**Firm Annual Yield (af)**	**Notes and Comments**
Transbasin Sources						
CBT Project						
Total units owned	3460					
Variable quota	3460	0.7	2422.0	0.6	2076.0	
Fixed quota	0					
Windy Gap Project						
Units owned	5	60.0	300.0	0.0	0.0	
Mutual Irrigation Company Ownership						
Greeley Loveland Irr. Co	147.93	13.1	1937.9	2.1	310.7	
Seven (7) Lakes	44.83	14.6	654.5	0.2	9.0	
Lake Loveland	19.75	45.5	898.6	0.7	13.8	
Godfry Ditch	24	42.1	1010.4	17.7	424.8	Non-Potable use Only. Evans Ditch is owned fully by the Town.
Evans Ditch	58.12	110.6	6430.0	98.7	5738.0	
Total			13653.4		8572.2	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form Water Supplier: **Town of Erie** Updated: 2/21/10						
Water Right Name	**No. of shares or Units Owned**	**Avg. Annual Yield (af/sh)**	**Annual Yield (af)**	**Dry Yr. Annual Yield (af/sh)**	**Firm Annual Yield (af)**	**Notes and Comments**
Transbasin Sources						
CBT Project						
Total units owned	7279					
Variable quota	7279	0.7	5095.3	0.6	4367.4	
Fixed quota	0	0.7	0.0	0.6	0.0	
Windy Gap Project						
Units owned	14	60.0	840.0	0.0	0.0	Has reuse capability when available.
Reservoir Storage						
Erie Reservoir	239		239.0		71.7	Water Decrees are for 239, 80, and 148 AF, respectivily. The remaining storage is used for C-BT.
Prince Reservoir	80		80.0		24.0	
Thomas Reservoir	148		148.0		0.0	
Mutual Irrigation Company Ownership						
Leyner Cottonwood Ditch	311.5	0.54	168.2		65.4	
South Boulder Canyon Ditch	203	2.9	588.7	0.0	0.0	610 shares total
Erie Coal Creek Ditch and Res. Co.	98		480.2		54.9	
FRICO - Marshall Lake Div.	8.24		33.0		4.1	
Total			7672.4		4587.5	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form
Water Supplier: **Ft. Collins - Loveland Water District**
Updated: 8/18/10

Water Right Name	No. of shares or Units Owned	Avg. Annual Yield (af/sh)	Annual Yield (af)	Firm or Dry Yr. Annual Yield (af/sh)	Firm Annual Yield (af)	Notes and Comments
Direct flow sources						
			0.0		0.0	1998 Poudre River right estimated to yield 1150 AF in 2010 - split between Tri-Districts
Transbasin Sources						
CBT Project						
Total units owned	11624					
Variable quota	11624	0.7	8136.8	0.6	6974.4	
Fixed quota						
Transferred from Windsor			336		336	Fixed by Contract
Mutual Irrigation Company Ownership						
NPIC (CBT Portion)	1312	4.7	6166.4	2.8	3673.6	
Jackson Ditch Co.	1.04	102.9	107.0	102.9	107.0	
John R. Brown Private Ditch	42%	235.7	99.0	145.2	61.0	
PVP Junior Water Right	42%	192.9	81.0	0.0	0.0	
Larimer Co Canal No. 2	0.42	42.9	18.0	33.3	14.0	Non Potable
Josh Ames/City of Ft. Collins	175	1.0	175.0	1.0	175.0	
Windsor Reservoir and Canal	37.5	14.1	527.0	9.1	341.0	
Divide Canal and Reservoir Class A	38	1.9	71.0	0.0	0.0	
Divide Canal and Reservoir Class B	41.5	2.9	122.0	1.1	44.0	
Total with Windsor Transfer			15821.2		11712.0	
Total w/o Windsor			15485.2		11376.0	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form Water Supplier: **City of Ft. Lupton** Updated: 10/22/2009						
Water Right Name	**No. of shares or Units Owned**	**Avg. Annual Yield (af/sh)**	**Annual Yield (af)**	**Firm or Dry Yr. Annual Yield (af/sh)**	**Firm Annual Yield (af)**	**Notes and Comments**
Direct flow sources						
Groundwater from well	100%		1350.0		0.0	Used to meet 5% of municipal demand in addition to golf course and park irrigation
Transbasin Sources						
CBT Project						
Total units owned	3107					
Variable quota	325	0.7	227.5	0.6	195.0	
Fixed quota	2782	0.7	1947.4	0.6	1669.2	
Windy Gap Project						
Units owned	3	60.0	180.0	0.0	0.0	
Mutual Irrigation Company Ownership						
Fulton Ditch	211.9		805.2		699.3	Total shares
Total			3704.9		1864.2	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form Water Supplier:City of Ft. Morgan Updated: 12/16/10						
Water Right Name	**No. of shares or Units Owned**	**Avg. Annual Yield (af/sh)**	**Annual Yield (af)**	**Firm or Dry Yr. Annual Yield (af/sh)**	**Firm Annual Yield (af)**	**Notes and Comments**
Direct flow sources						
Wells	100%		625.0		850.0	Used for current and projected open space irrigation and Excel Beef
Transbasin Sources						
CBT Project						
Total units owned	5290					
Variable quota	5290	0.7	3703.0	0.6	3174.0	
Fixed quota	0	0.7	0.0	0.6	0.0	
(leased)	2837	0.7	1985.9	0.6	1702.2	Water leased from Riverside Irrigation Co.
Mutual Irrigation Company Ownership						
Fort Morgan Reservoir and Irrigation Co.	129	10.00	1290.0	0.00	0.0	Used for well augmentation only; not included in total
Platte Avenue Lateral Co.	8	Carrying rights only, no water				
South Side Lateral Co.	50					
Jackson Lake Reservior and Irrigation Co	13.5	16	216	14	189	
Total for Municipal Use			4328.0		4024.0	
Total with leased			6313.9		5726.2	

Note: The 1,702 AF of leased water from Riverside Irrigation Company has not been included in the future supply for Fort Morgan as it will not be available long-term. (Carl Brouwer, 2011)

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form
Water Supplier: **Town of Firestone**
Updated: 3/18/10

Water Right Name	No. of shares or Units Owned	Avg. Annual Yield (af/sh)	Annual Yield (af)	Firm or Dry Yr. Annual Yield (af/sh)	Firm Annual Yield (af)	Notes and Comments
Transbasin Sources						
CBT Project						
Total units owned	4982					
Variable quota	4982	0.7	3487.4	0.6	2989.2	
Fixed quota						
Total			3487.4		2989.2	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form Water Supplier: **Town of Frederick** Updated: 3/16/10						
Water Right Name	**No. of shares or Units Owned**	**Avg. Annual Yield (af/sh)**	**Annual Yield (af)**	**Firm or Dry Yr. Annual Yield (af/sh)**	**Firm Annual Yield (af)**	**Notes and Comments**
Transbasin Sources						
CBT Project						
Total units owned	3467					
Variable quota	3467	0.7	2426.9	0.6	2080.2	
Fixed quota						
Reservoir Storage						
Baseline Reservoir	0.6625	12.4	8.2	5.3	3.5	These supplies available and used for non-potable irrigation only
Milavec Lake	1		750.0		450.0	
Mutual Irrigation Company Ownership						
Coal Ridge Ditch	8	1.3	10.4	1.1	8.8	
Lower Boulder Preferred	20.1667	46.9	945.8	43.7	881.3	
Lower Boulder Common	5.5	8.90	49.0	0.0	0.0	
Total			4190.3		3423.8	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form
Water Supplier: **Lafayette**
Updated: 8/12/09

Water Right Name	No. of shares or Units Owned	Avg. Annual Yield (af/sh)	Annual Yield (af)	Firm or Dry Yr. Annual Yield (af/sh)	Firm Annual Yield (af)	Notes and Comments
Transbasin Sources						
CBT Project						
Total units owned	455					
Variable quota	455	0.7	318.5	0.6	273.0	
Fixed quota						
Windy Gap Project						
Units owned	1	60.0	60.0	0.0	0.0	
Reservoir Storage						
Baseline Land and Reservoir Company	375.546					
Henry Waneka Mutual Rexervoir Company	714					
Mutual Irrigation Company Ownership						
Coal Ridge Ditch Company	258		324.0		190.0	
New Consolidated Lower Boulder Reservior and Dtich Company	46.16		1901.0		1653.0	
Common Shares	7		60.0		0.0	
Davidson Ditch and Reservoir Company	690.385		427.0		0.0	288.5 shares are untransferred
Dry Creek No. 2 Ditch Company	61		819.0		641.0	
Goodhue Ditch and Reservoir Company	1009.024		360.0		0.0	5.833 shares are untransferred
Howard Ditch Company	28.22		656.0		656.0	
Leyner-Cottonwood Consolidated Ditch Company	668		441.0		141.0	134 shares are untransferred
South Boulder and Bear Creek Ditch Company	17		954.0		954.0	
South Boulder Canon Ditch Company	20		78.0		0.0	20 shares are untransferred
Total			6398.5		4508.0	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form
Water Supplier: **Left Hand Water District**
Updated: 1/03/10

Water Right Name	No. of shares or Units Owned	Avg. Annual Yield (af/sh)	Annual Yield (af)	Firm or Dry Yr. Annual Yield (af/sh)	Firm Annual Yield (af)	Notes and Comments
Transbasin Sources						
CBT Project						
Total units owned	6750					
Variable quota	6750	0.7	4725.0	0.6	4050.0	
Fixed quota						
Reservoir Storage						
LH Ditch storage	1400	100.0%				1000 for CBT through agreement and 400 ownership
District Storage	290	100.0%				Dodd and Spurgeon WTP Reservoirs
Mutual Irrigation Company Ownership						
Left Hand Ditch Company	2854	0.90	2568.6	0.6	1712.4	LHWD receives 85% of share allotment by agreement; Actual ownership is 2854 shares, but can only be delivered to customers within company service area.
Total			7293.6		5762.4	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form
Water Supplier: **Morgan County Quality Water District**
Updated: 3/16/2010

Water Right Name	No. of shares or Units Owned	Avg. Annual Yield (af/sh)	Annual Yield (af)	Firm or Dry Yr. Annual Yield (af/sh)	Firm Annual Yield (af)	Notes and Comments
Direct flow sources						
Wells (7 Total)			2271.0		2271.0	
Transbasin Sources						
CBT Project						
Total units owned	1052					
Variable quota	1052	0.7	736.4	0.6	631.2	
Fixed quota						
Total			3007.4		2902.2	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form
Water Supplier: **Severance**
Updated: 3/16/2010

Water Right Name	No. of shares or Units Owned	Avg. Annual Yield (af/sh)	Annual Yield (af)	Firm or Dry Yr. Annual Yield (af/sh)	Firm Annual Yield (af)	Notes and Comments
Direct flow sources						
Wells			55.0		55.0	Not metered; used as needed for parks and green belt irrigation
Transbasin Sources						
CBT Project						
Total units owned	792					
Variable quota	792	0.7	554.4	0.6	475.2	
Fixed quota						
Mutual Irrigation Company Ownership						
NPIC (CBT Portion)	45	2.8	126	2.4	108	
NPIC (Native portion)	45	2.4	108.0	1.2	54	Not currently available for Municipal use and not included in total.
Finley Lateral						Carrying right only
Total			735.4		638.2	

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NISP Participants' 2010 Water Supply Inventories

NCWCD Water Supply Inventory Form
Water Supplier: **Town of Windsor**
Updated: 11/2/2004

Water Right Name	No. of shares or Units Owned	Avg. Annual Yield (af/sh)	Annual Yield (af)	Firm or Dry Yr. Annual Yield (af/sh)	Firm Annual Yield (af)	Notes and Comments
Transbasin Sources						
CBT Project						
Total units owned	3466					
Variable quota	1365	0.7	955.5	0.6	819.0	
Fixed quota	2101	0.7	1470.7	0.6	1260.6	
Mutual Irrigation Company Ownership						
NPIC (CBT Portion)	350.5	2.8	981.4	2.4	841.2	
NPIC (Native portion)	350.5	2.4	841.2	1.2	420.6	Not currently available for Municipal use and not included in total.
Non-Potable						
Kern Reservoir and Ditch Co	100		1800.0		0.0	
B.H. Eaton Ditch Co.	2		52.0		0.0	
Witney Ditch Co.	2		66.0		0.0	
Total			5325.6		2920.8	