CITY OF FORT LUPTON
WATER CONSERVATION PLAN

August 2007

Prepared by:

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water rights • planning • engineering

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CHAPTER 1 – INTRODUCTION

The City of Fort Lupton is located east of the South Platte River along Highway 85. The City's municipal drinking water was historically supplied from alluvial wells. This well water was used for domestic use as well as irrigation of parks and open space areas. In early 1997, the City shifted its water supply from well water to Colorado Big Thompson (CBT) water when it constructed a 3-million-gallon-per-day (MGD) water treatment plant (WTP). The Town of Hudson participated in 1/6th of this WTP construction. In 2001, the City expanded the WTP to a capacity of 5 MGD. Hudson did not participate in the enlargement.

The City encountered a unique water quality problem when it transitioned to CBT water. The well water that was historically delivered through the pipe distribution system had high hardness levels. As a result, this caused a build up of minerals along the pipe walls. When the City changed to the much softer CBT supply in 1997, the softer mountain water caused the historic build up of mineral deposits to begin to permeate back into the water supply, thus impacting water quality. From 1997 through the summer of 2005, the City blended sufficient well water with the CBT to maintain an acceptable level of hardness in the finished water supply to prevent this from occurring. The City performed a water quality study in 2005 and ceased the use of groundwater for blending in June 2005. The City is now adding minimal levels of Zinc Phosphate into the mountain water supply to keep the build up intact while providing an improved water supply to its constituents. As the City replaces outdated infrastructure within its distribution system in the future, the use of Zinc Phosphate will reduce and eventually be eliminated. The City continues to use its wells for non-potable irrigation of its parks, schools, open space areas, and its golf course. It also supplies a local power plant (Thermo) with well water.

The Thermo Power Plant is operated by Thermo Cogeneration Partnership and was annexed into the City in 1994. Thermo provides electric power through Public Service throughout the State of Colorado. Thermo uses City well water for cooling of its electric generators. A portion of the water delivered to Thermo is also delivered to the Colorado Greenhouse (CGH) facility to grow vegetables. The total non-potable use from Thermo and CGH nearly equals the City's total potable water use.

Like other Front Range cities, Fort Lupton is slated for significant growth. The need to provide water to meet this growth, coupled with the fact that water is becoming less available and more expensive with time, adds new water challenges for the City. The City recognizes the importance of water conservation and doing its part to preserve water supplies in the region for future generations. Since the City uses mountain water and well water, water conservation for Fort Lupton means potential benefits to both the potable and non-potable supplies. Reduction in well water usage also reduces augmentation

costs, another benefit to conserve water use. In order for the City to be successful in water conservation, the citizens of Fort Lupton must be involved through education and participation. This report will outline the planned conservation measures and programs with sufficient input from City Council, City staff and the public, so the City can reach its water conservation goals.

CHAPTER 2 – DEFINITION OF TERMS

Acre-foot:	The amount of water it would take to cover one acre of land to a depth of one foot; approximately 325,851 gallons.
Augmentation:	One-for-one replacement of water to the stream system for groundwater that is consumptively used. The City's well pumping requires augmentation.
Consumptive Use:	Water that is consumed and not returned to the stream system.
Effluent Percentage:	The percentage of water delivered through the WTP that eventually shows up at the wastewater treatment plant (WWTP).
Maximum Day:	The largest amount of water used in a single day.
Peak Hour:	The largest amount of water used in a single hour – typically occurs on the Maximum Day.
Potable Use:	Water that is treated to drinking water standards for municipal use, including residential and commercial use. The City's CBT and Windy Gap water is used for potable use.
Non-Potable Use:	Water that is not treated and either used for irrigation or other uses than potable, i.e. Thermo and City parks and open spaces. The City's well water is used for non-potable use.
Return Flows:	A portion of a water right that was historically used for irrigation that was not consumed by the crops and made its way back to the river system as surface water and groundwater. The City's Fulton Ditch water came from irrigated lands that have associated return flows from the historic irrigation practices.
SFE:	Single Family Equivalent – the amount of water used in a typical single-family home.

CHAPTER 3 – PROFILE EXISTING WATER SYSTEM

Physical Characteristics of the Existing Water System

Figure 3.1 shows the location of the City and its major water facilities.

Potable Water System

The City of Fort Lupton serves approximately 7,200 people over an area of six square miles. The City receives its CBT and Windy Gap water from Carter Lake through a 20-inch pipeline that flows south from the Town of Platteville. Water from the CBT system is treated in the City's WTP. Once treated, the water is delivered to both the Town of Hudson and the City of Fort Lupton. Fort Lupton residents are fed potable water via a 3-MG storage tank and subsequently two 1-MG water tanks (a.k.a the Tank Farm) located on College Avenue, just west of Aims Community College. The water is distributed from this Tank Farm to the City's customers. In 2006, the WTP had an average-day demand of 1.3 MGD and a maximum-day demand of 2.9 MGD.

Non-Potable Water System

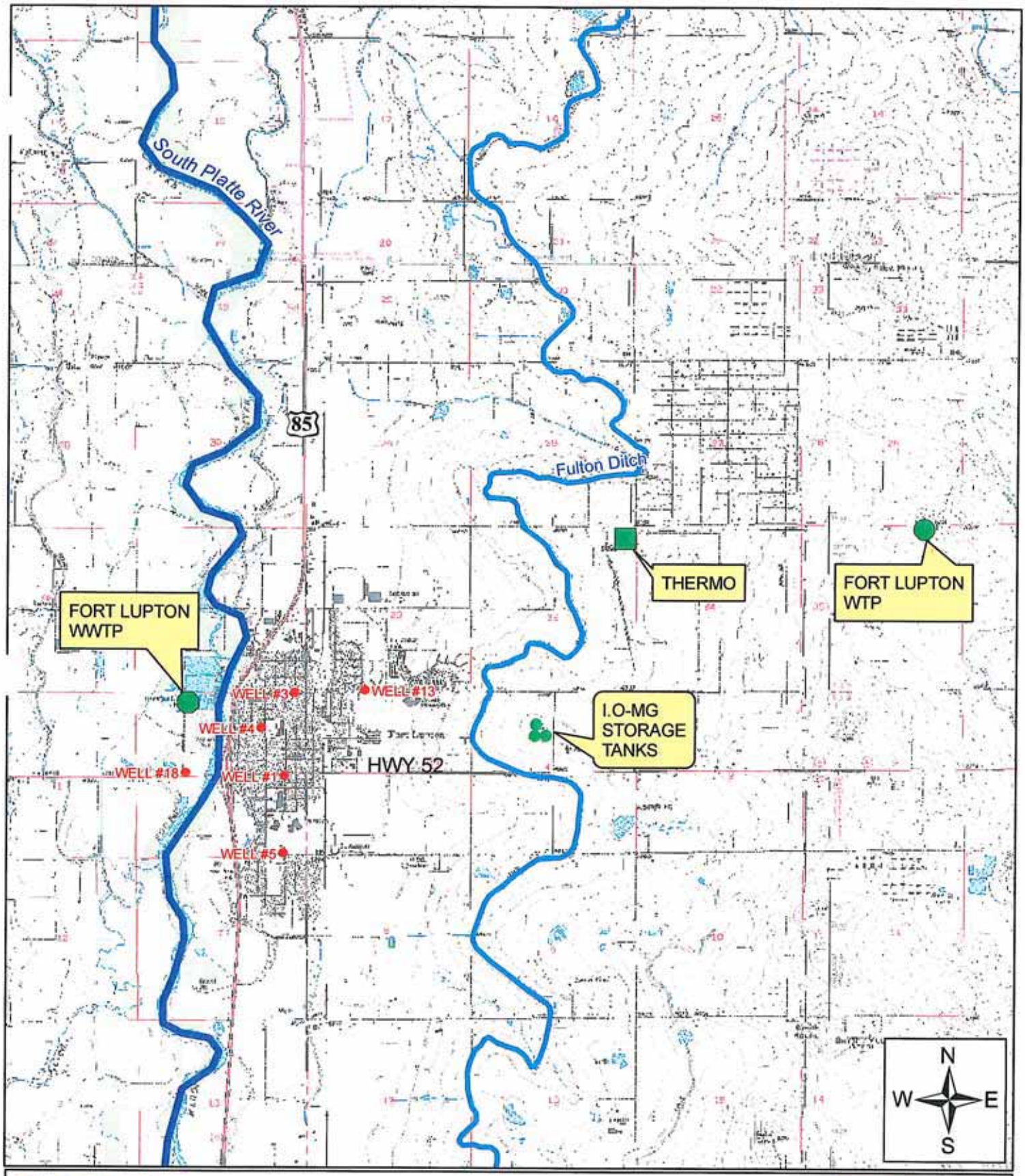
The City currently uses five alluvial wells connected through a manifold system to fill the third 1-MG tank at the tank farm with well water. Water from this 1-MG tank is used for two separate and distinct purposes: 1) to irrigate portions of the golf course and City open spaces and 2) to deliver water to the Thermo Power Plant and CGH.

The City has a sixth well, located on the west side of the river, that is used to irrigate Pearson Park and for minor water uses within the WWTP. This well operates separately from the five wells on the manifold.

The Fulton Ditch flows north through the City. Currently, the City uses its Fulton water to irrigate the golf course and cemetery. The City's Fulton water is also routed back to the South Platte River for augmentation of the City's well use.

Water Distribution System

Fort Lupton currently has approximately 47 miles of water distribution mains as shown in Table 3.1. These mains run from the WTP down to and throughout the City. In terms of factors that affect the long-term reliability and adequacy of the piping system, the mains can be broken down into two very broad categories – lines constructed prior to the mid-1970's and lines installed subsequent to the mid-1970's. The older lines have shown significant problems with tuberculation or deposition of minerals from the pre-1997 well water system. In practice, these



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Feet

CITY OF FORT LUPTON

MAJOR WATER FACILITIES

FIGURE 3.1

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lines will eventually need to be replaced to re-capture the capacity of the distribution system.

Table 3.1 – Water Line Information

Pipeline Size (in)	Pipeline Length (ft)	Pipeline Length (mi)
30	1,338	0.25
24	6,689	1.27
21	2,348	0.44
20	30,379	5.75
18	7,866	1.49
15	237	0.04
12	23,892	4.52
10	11,346	2.15
8	78,997	14.96
6	48,389	9.16
4	35,491	6.72
Total	**246,972**	**46.78**

Sewer System

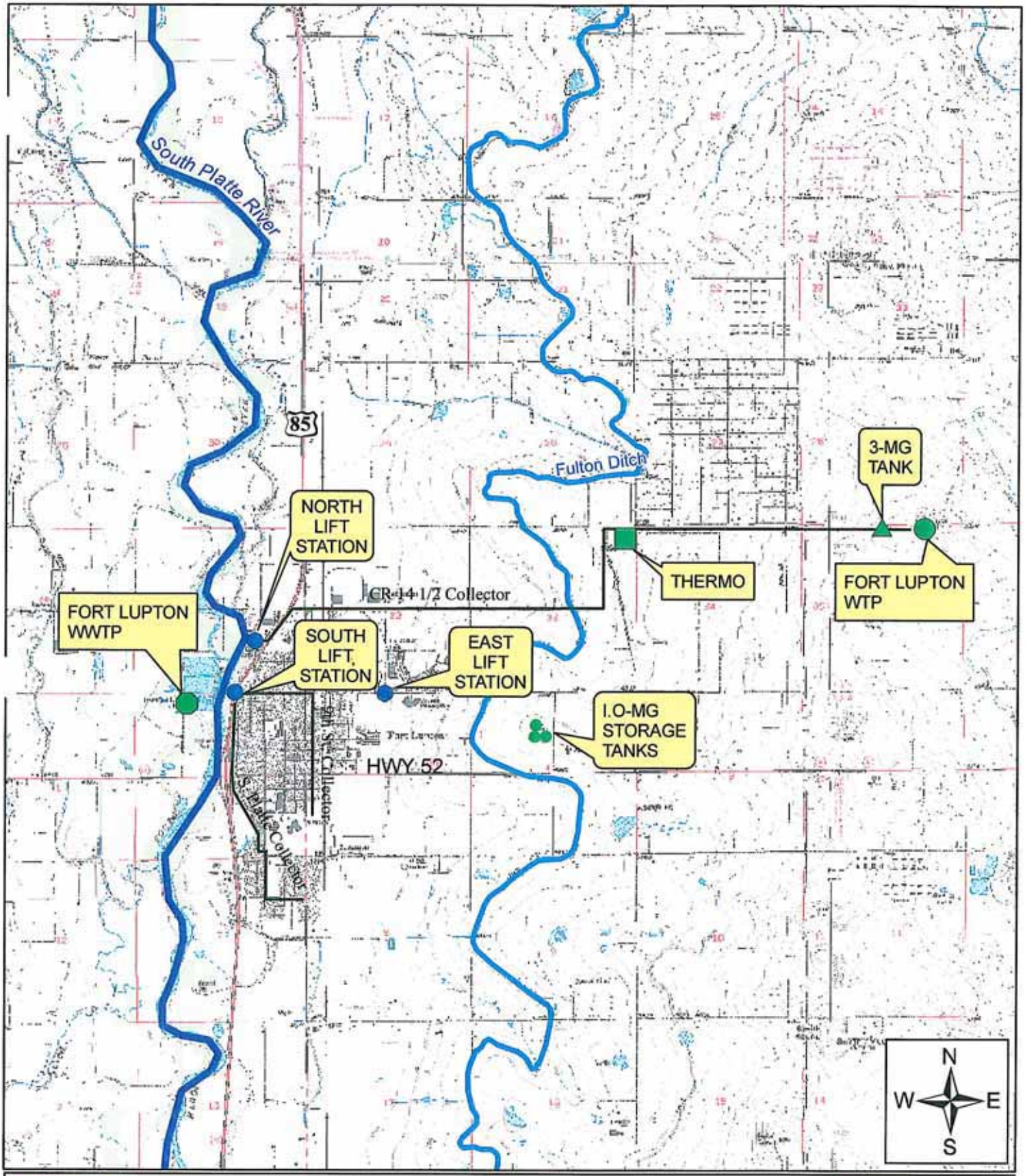
Figure 3.2 shows the City's main collector sewer lines, lift stations and wastewater treatment plant.

The City's wastewater is collected by three sewer collectors. The CR 14 ½ collector collects water from the WTP, Thermo, CGH, the industrial property west of Hwy 85, and some minor residential use and delivers the wastewater to the north lift station. The CR 14 ½ collector flows along CR 14 ½ west under Hwy 85 to the north lift station. The east lift station is located on 9th Street at the northwest corner of the Coyote Creek Golf Course. This station pumps sewer from the Coyote Creek developments and delivers the wastewater to the CR 14 ½ collector which, in turn, delivers the wastewater to the north lift station before entering the WWTP.

The South Platte collector collects wastewater from the southern part of the City, between Hwy 85 and the Union Pacific Railroad. The sewer line flows along the eastern edge of Hwy 85 before entering the south lift station located at 9th Street and Hwy 85.

The 9th Street collector runs north along Harrison and west along 9th Street. This collector also discharges into the south lift station.

Both stations deliver wastewater under the South Platte River to the WWTP. The WWTP has a capacity of 2.3 MGD with current-day demand of 1.9 MGD. Although the sewer system does not directly relate to the Water Conservation Plan and goals, having



0 2,000 4,000
Feet

CITY OF FORT LUPTON

MAJOR SEWER FACILITIES

FIGURE 3.2

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perspective will assist in the overall understanding of the City's water and wastewater utilities. In addition, all potable water savings inside homes and businesses will have a direct impact on the costs of operating the City's WWTP. Currently, the City is in negotiation to treat wastewater from a very large development outside of City limits. Part of the agreement would be a joint expansion of the City's WWTP facilities.

Sources of Water

Well Water

The six alluvial wells are summarized at follows:

Table 3.2 – Well Information

Well #	Well Permit #	Legal Description	Pumping Capacity (gpm)	Approximate Age (yrs)
1	19493-1/RF-151	NE1/4, SE1/4, Sec 6, T1N, R66W	1297	45
3	19493-3/RF-545	NE1/4, NE1/4, Sec 6, T1N, R66W	1096	38
4	12626-R	NW1/4, NE1/4, Sec 6, T1N, R66W	996	50
5	20026-R	SE1/4, SE1/4, Sec 6, T1N, R66W	1095	65
13	15273-R	SE1/4, SW1/4, Sec 32, T2N, R66W	996	60
18	6588-RF/34329-F	SE1/4, NW1/4, Sec 6, T1N, R66W	500	56

The wells are approximately 50 to 60 feet deep, except Well 18 located west of the river, which is 30 feet deep. The wells were originally drilled in the 50's and 60's and range from 38 to 65 years old. The wells are drilled into the South Platte alluvium. The groundwater level in this aquifer has remained relatively level for the last 25 years because of recharge from precipitation, irrigation and return flows from upstream municipalities. The water is available year-round and is a highly productive, reliable resource. One drawback to well water is the groundwater is high in total dissolved solids and nitrates. However, the major drawback is the use of the water requires augmentation. Well water is used for non-potable irrigation of the golf course, schools, parks and open space, and for deliveries to Thermo and CGH.

The City has been working diligently to calibrate its well and park meters, so accurate water use can be determined. In early 2005, the City finished a two-year meter replacement and calibration program. All wells are currently metered, and the meters are calibrated on an annual basis to ensure accuracy.

Surface Irrigation Water

The City has 217.9 shares of Fulton Ditch water. Each share of Fulton Ditch water delivers approximately 3.8 ac-ft and has an estimated historic consumptive use value of 1.75 ac-ft per share. The Fulton Ditch water is used for irrigation of the golf course and cemetery and is also used for augmentation of the City's wells. This water right is seasonal, delivering water from April to October in most years.

Mountain Water

The City uses both CBT and Windy Gap water from the CBT project for its potable water supply. Because the CBT system has storage, both CBT and Windy Gap water can be delivered year-round. Fort Lupton uses its CBT water primarily in the summer months and its Windy Gap water primarily in the winter months. Since CBT is one-time use only water, this raw water supply is ordered and delivered in the summer months when the effluent percentage is low. The effluent percentage is the percentage of water delivered out of the WTP that eventually shows up at the WWTP. In the summer months, the majority of the water delivered from the WTP is used for outdoor lawn irrigation. Because a large portion of the water never makes it to the sewer system, only 35% to 40% is collected in the sewer systems and delivered to the WWTP. Conversely, in the winter months, little water is used outside. As a result, the water used in the winter collects in the sewer system through sinks, showers and toilets. The effluent percentages reach up to 90% in the wintertime. Since Windy Gap is fully consumable, using Windy Gap in the winter months maximizes the reusable component of Windy Gap. There are great efficiencies to operate the system this way.

Figure 3.3 below shows the total water use (potable + non-potable) from each water source. The total estimated City water use is 3,000 ac-ft. Figure 3.4 shows the total surface water versus groundwater use.

Figure 3.3 – Water Use by Source

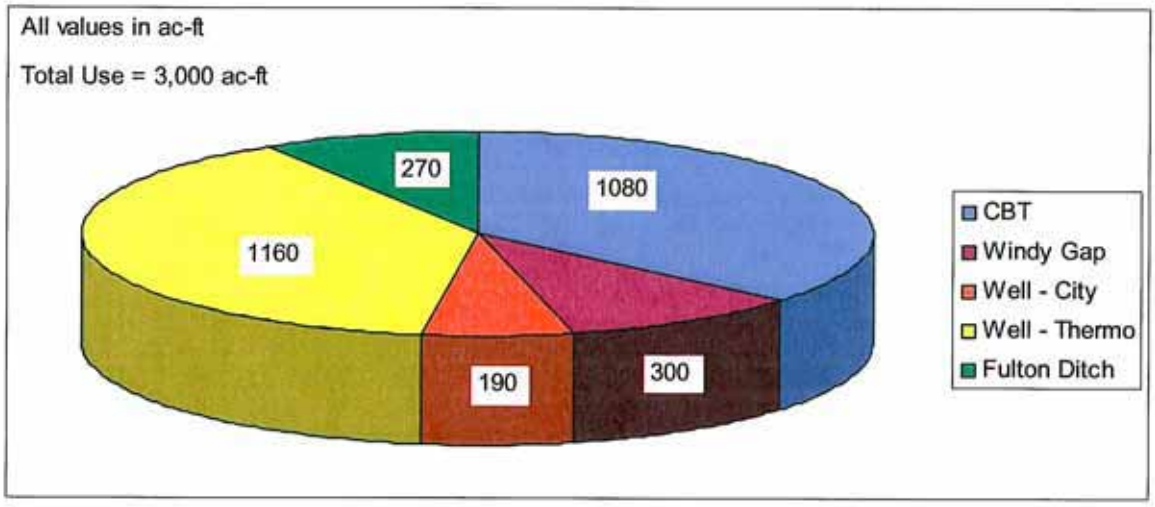
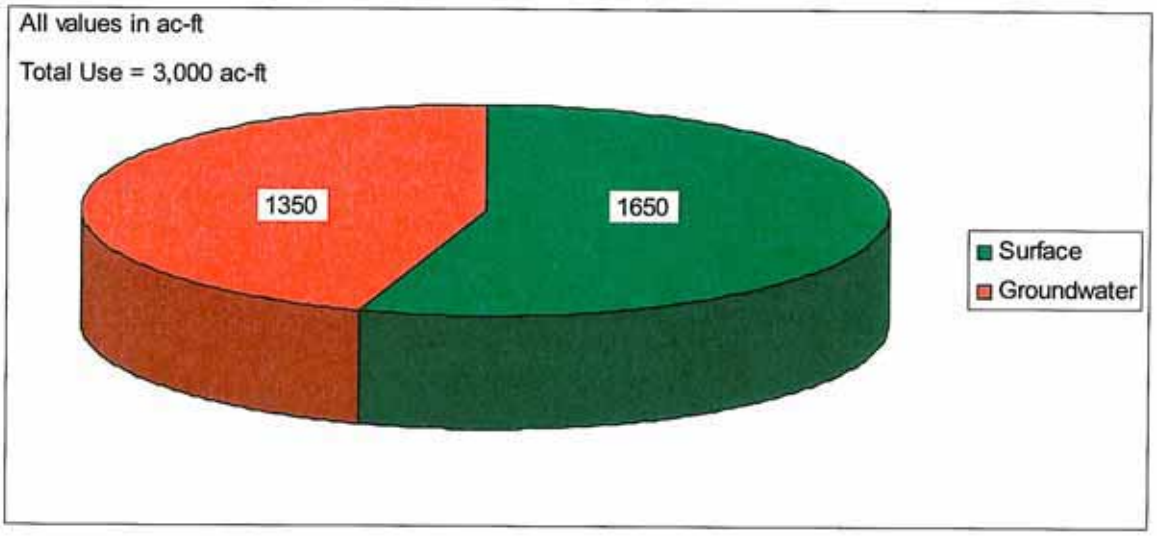


Figure 3.4 – Surface vs. Groundwater



System Limitations

As part of providing an overall perspective, it is appropriate to also provide insight into potential system limitations. Accordingly, major limitations of the water supply components have been provided.

Well Water

The City's well water supply is very reliable since the aquifer is replenished on an annual basis. The age of the wells is less than ideal, but on-going maintenance and repair have extended the life of these wells. Use of well water requires augmentation to the stream system. Since the City will continue to operate its wells for irrigation and for Thermo and CGH, it must plan on how to address augmentation now and into the future.

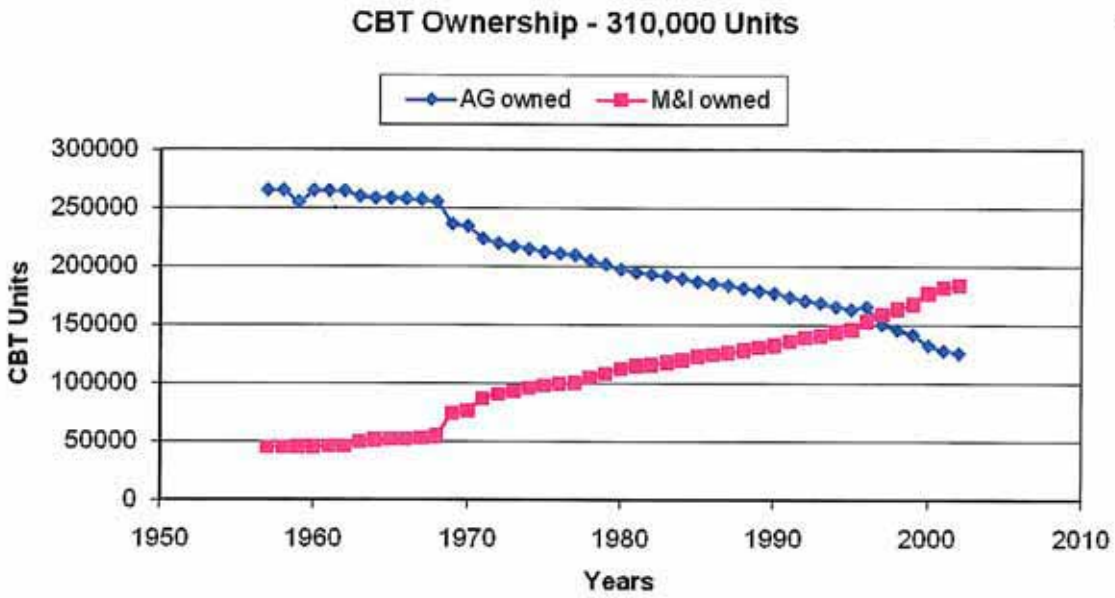
Fulton Ditch Water

The Fulton Ditch water owned by the City is 100% utilized at this point. Between irrigation of the golf course and cemetery and augmentation of its well usage, the City's 217.9 shares are sufficient to meet current needs. The City will continue to need additional Fulton Ditch water or other augmentation water sources as it grows. The primary concerns with Fulton Ditch water is its cost due to increased demand for the water and if it is used for any use other than irrigation, i.e. augmentation, the winter return flow component must be maintained at the South Platte River. Although the Fulton water delivers seasonally from April through October, use of the water for augmentation requires replacements year round. The City must manage its water supplies to address this issue.

Mountain Water

Fort Lupton is on the cusp of experiencing a high rate of growth. The CBT and Windy Gap supplies are currently sufficient to meet demands, and to date, there have not been any shortages from a potable supply standpoint. Over the years, the City has received more CBT water through dedication than allowed by Northern Colorado Water Conservancy District (NCWCD) regulations (Resolution D-962-02-95). Accordingly, the City cannot purchase additional CBT supplies through the open market and must rely on additional acquisition of CBT through dedication from developers. This requirement puts a burden on the City to figure out other ways to extend its water supplies since it cannot purchase additional CBT water in the open market. CBT water is in great demand and is converting from agricultural use to municipal/industrial use rapidly. In the late 1950's, CBT ownership was 85% agricultural owned and 15% municipal/industrial owned. Today, the estimated ownership is 65% municipal/industrial and 35% agricultural. The chart below shows the ownership transition.

Figure 3.5 – CBT Ownership Transition



Because CBT is in such high demand, Fort Lupton is faced with a difficult challenge. In order to fund other water acquisitions, such as its recent purchase of Windy Gap supplies, the City has switched from a CBT dedication policy to a cash-in-lieu policy. However, since CBT is being obtained by other municipalities so quickly, one of the greatest challenges the City must face in the near future is whether to switch back to CBT dedication while this precious resource is still available.

Infrastructure

The City water system currently consists of a "High Pressure Zone" and a "Low Pressure Zone" to provide water to its residents. These zones refer to the location of the zone with respect to geographic location and elevation, not the actual pressure

supplied to residents. To accommodate future growth, the City will need to serve areas outside of these pressure zones in the future. To accomplish this, the City will need additional infrastructure to provide water to areas outside its current infrastructure.

Water Costs and Pricing

As with all aspects of managing a water utility, many decisions are based on a cost-benefit analysis. Accordingly, we have included the City's most current rate structures for reference.

Rate Structure

In response to ordinances requiring a review of water rates at least every two years, and as part of the 2003 Drought Response Plan, the City reviewed its rates and resultant revenue shortfalls to fund ongoing operations. The City currently reviews and sets its rates annually during its budget process. As a result, a Resolution was established for a two-tier water rate structure. In 2006, the City added a third tier. The City has one rate structure for all customer types, except Thermo and Parks. The City's current and past rate structure is shown in the table below.

Table 3.3 – Past and Current Rate Structure

	Prior to June 2004	After June 2004	2005	2006
Base Fee	$22.50	$27.50	$27.50	$27.50
Water Usage Blocks	Rate per 1000 gallons			
Potable Rates				
< 12,000 gal	$2.85	$3.20	$3.26	$3.43
12000 gal - 20000 gal	$2.85	$3.65	$3.72	$3.91
> 20000 gal	$2.85	$3.65	$3.72	$5.15
Non-Potable Rates				
Thermo	$0.28	$0.28	$0.28	$0.29
Parks	$0.50	$0.50	$0.50	$0.50

Water Revenue

The City divides its water customers into Residential, Commercial/Industrial, Schools, Multi-Family, Hotels/Motels, and City Irrigation. The City's water sales per customer category from 2002 to 2005 are shown in the following table.

Table 3.4 – Water Revenue by Customer Category

Customer Category	2002	2003	2004	2005
Residential	$586,274	$569,696	$563,291	$649,873
Commercial/Industrial	$153,945	$156,998	$125,443	$112,651
Schools	$82,691	$43,440	$75,968	$78,320
Multi-Family	$108,318	$88,050	$87,700	$107,929
Hotel/Motel	$8,016	$5,162	$4,697	$6,135
City Irrigation	$1,755	$5,416	$53,774	$16,465
Total	$940,999	$868,762	$910,873	$971,373

Billings and Collections

The City follows these steps for billings and collections.

1. Statements for the charges of water service will be dated and mailed out to water users monthly by the 18th of each month. Customers will have until the end of the following month to pay said bill.
2. In the event that the utility bill is not paid by the end of the following month in which it was sent, the City shall serve upon or mail the customer a delinquent notice, in writing, notifying the customer that they have ten days from the date of the notice to pay the delinquent amount or the water will be turned off to the premises.

In the event that the utility bill is not paid within the ten-day delinquency notice, the City shall begin delinquency shut-off procedures as follows:

3. If payment of the past due balance is not received by 12:00 noon on the day before scheduled shut-off date, the City or its agent(s) shall shut-off water service to the premises and a $40.00 nonpayment charge shall be added to the past due balance to cover costs to the City in activating shut-off procedures. This fee and the past due balance must be paid prior to water service being restored.
4. If a customer cannot pay the entire balance due, they may, upon request in writing, ask to arrange a payment schedule. However, all pay arrangements must be made by the customer prior to 12:00 noon on the day before scheduled shut-off date.
5. If payment is not made as arranged, water will be shut-off with a 24 notice, and water will not be restored until the past due balance and the $40.00 nonpayment charge is paid. Arrangements will not be made on prior arrangements.
6. If, after following through on the delinquency shut-off procedures, the account still remains unpaid, the City shall file a lien upon the real property served on all water and sewer charges, service charges and fees. Said lien shall not be discharged until all fees and costs have been paid.
7. In the event the lien provided in (6) above is not discharged by payment, the City or its agent(s) shall be authorized to collect such delinquent charges for water

and sewer charges, service charges and fees, and charge such collected amounts in the same manner as taxes, pursuant to Colorado Revised Statutes 31-15-302.

Alternately, upon the election of the City Council, proceedings may be instituted for the collection of amounts due by the County Treasurer pursuant to Colorado Revised Statutes 31-20-105.

In the event of any collection process, the City shall also be entitled to collect from the customer or the property owner, all attorney's fees and reasonable costs incurred in the collection process

The City averages between 30 and 40 account shut-offs each month. The shut-off day is the second Tuesday of each month.

Current Policies and Planning Initiatives

The City of Fort Lupton has enacted numerous water conservation policies and ordinances. Some ordinances are in place continuously. Other policies and ordinances are in place and can be enforced annually depending on CBT yield.

The City completed a Raw Water Master Plan in 2003. The plan evaluated growth and developed a water acquisition plan to meet that growth. Various water resources were identified for purchase and future water storage needs were quantified. The City's raw water dedication policy was evaluated and changes were recommended to help fund water acquisition.

A Drought Response Plan was also completed in 2003. This plan helped the City respond to the drought by evaluating water needs and developing short-term solutions to solve those water needs.

In addition, in 1999 the City completed a Water and Wastewater Master Plan that addressed infrastructure needs and capital improvement costs. This report also evaluated growth and identified capital improvement projects needed to meet this growth.

Current Water Conservation Activities

As previously discussed, the City has more CBT water than it currently needs. As a result, the City has not had to implement strict water conservation measures. Since 2003, by Resolution 2003-002, the City has implemented the following water restrictions.

1. No outside watering from 10 am to 6 pm every day beginning May 1st and ending August 31st.

2. Exclusions and exceptions include:
    - Coyote Creek Golf Course – greens and tee boxes.
    - Waivers for new lawns, except for the period June 1st through August 31st.
    - Residential car washing provided that a bucket and a hand-held hose with a shut-off nozzle are used.
    - Commercial car washes.

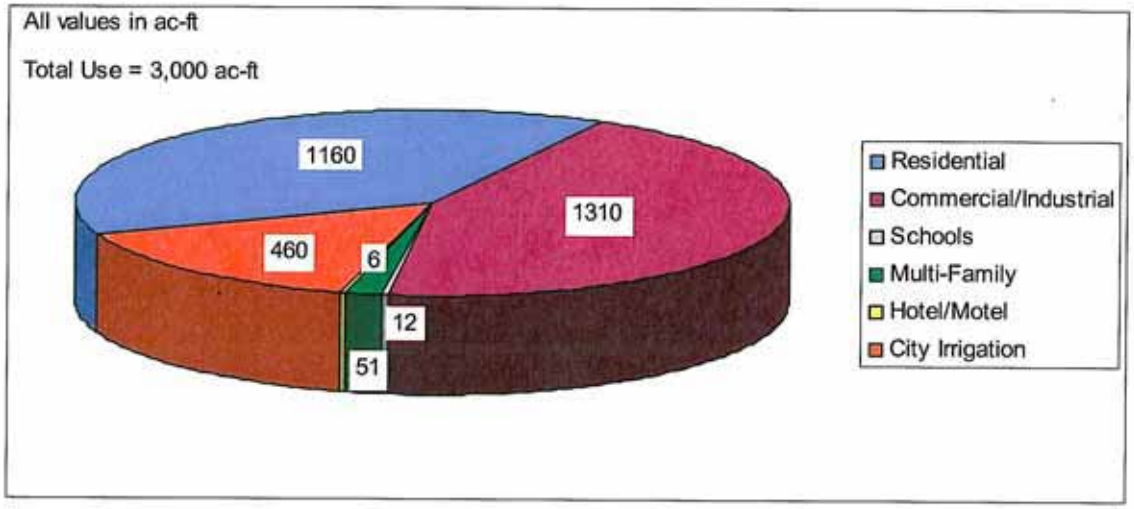
This water restriction has been in place every year since 2003. Each year on the March Utility Bill, the City includes a message depicting the watering restrictions that will be in place for the upcoming irrigation season. An article is also put into the Fort Lupton Press. Although the City believes this annual watering restriction has helped, the benefits of this conservation measure have been difficult to quantify to date. Again, the excess mountain water supplies have not required the City to focus on water use as much as some other water providers with more limited resources.

Current Water Use

The City supplies water to Residential, Commercial/Industrial, Schools, Multi-Family, Hotel/Motel, and City Irrigation. Two large industrial water users, Thermo (1160 ac-ft) and Golden Aluminum (81 ac-ft), are part of the Commercial/Industrial customer category. The largest user within the City Irrigation category is the Coyote Creek Golf Course (310 ac-ft).

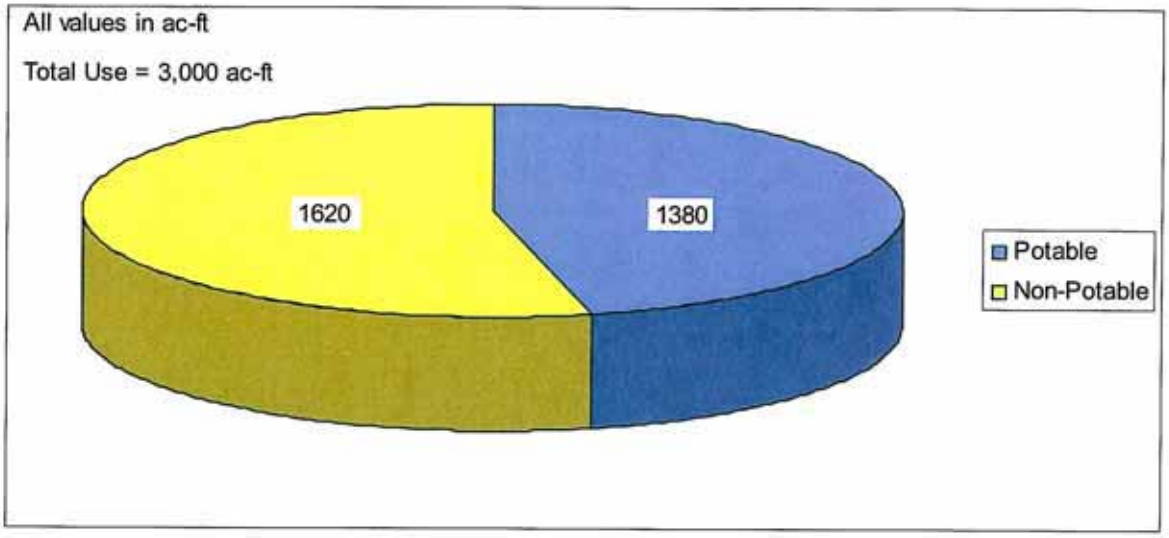
The current water use by customer category can be seen in the following graph.

Figure 4.1 – Current Water Use by Customer Category



The above uses are divided into potable and non-potable to provide additional perspective and to assist in the water use quantification process. This division is shown in the chart below.

Figure 4.2 – Potable vs. Non-Potable



Billing Data and Current Water Demand Estimates

In practice, the amount of water produced at the WTP should closely approximate the total amount of water registered by the service meters. However, in actual systems, there is always some amount of produced water that is not recorded by the billing meters. Sources for this discrepancy include meter inaccuracies, system leaks and un-metered use such as periodic flushing of distribution lines and fire-hydrant testing.

The lower the percentage of unaccounted-for water, the tighter the system. Systems are generally classified as "tight" when the percentage of unaccounted-for water is seven percent or less. The percentage of unaccounted-for water in the City of Fort Lupton water system needs to be estimated based on winter season billing records to reduce the amount of unaccounted-for water due to miscellaneous un-metered irrigation and hydrant testing. The City's total annual water use as determined from meters at the parks, Thermo and CGH, and WTP is 3,000 ac-ft. Since all park, Thermo and CGH, and WTP meters have been replaced and/or calibrated, this number is believed to be accurate. However, the sum of all billing records shows a total annual water use of approximately 2,500 ac-ft. Although the system will have some unaccounted-for water, this 500 ac-ft difference is much too high. Therefore, the City will need to develop an action plan to figure out this discrepancy and to determine whether or not the distribution system has excessive leakage. This plan will include leak detection and repair and/or service meter replacement. For the purpose of this study, the total water use of 3,000 ac-ft is used.

Largest Water Users

As shown in Figure 4.1, the bulk of the City's water use is generated from Residential, Commercial/Industrial and City Irrigation. The largest Commercial/Industrial user is Thermo, using 1,160 ac-ft of the total 1,310 ac-ft in this category. The largest City Irrigation user is the Coyote Creek Golf Course, using 310 ac-ft of the 460 ac-ft. The water use from Thermo and the golf course is summarized in the following table.

Table 4.1 – Non-Potable Water Use by Two Largest Water Users

Customer (Category)	Water Use (ac-ft)	Total Water Use in Customer Category (ac-ft)	% of Total per Customer Category (%)
Thermo (Commercial/Industrial)	1160	1310	89%
Golf Course (City Irrigation)	310	460	67%

Demand Forecast

Residential Water Demand

To properly assess future water demands, it is first necessary to conduct an analysis of historical and projected population growth. Population data was taken from the Colorado Department of Local Affairs (CDOLA). CDOLA uses Census data as well as research performed by the State Demographer to determine population. The City's population is projected to grow at 3% per year. This projected growth rate is based on the number of future taps that the City is currently committed to serve, the construction of proposed commercial developments, and recent interest shown in developing new subdivisions, including lands to the south of the City proposed to be included in the Denver Avenue Special Improvement District.

In general, Weld County is expected to experience a substantial increase in growth rates due to proposed residential developments. This is partially a consequence of the Denver International Airport and completion of E-470 and other commercial/industrial developments in Weld County and adjacent counties.

As mentioned earlier, there are considerable discrepancies between the City's billing records and the City's master meter records. For example, the billing records show that the 2005 residential water use is 593 ac-ft and the City has 1,908 taps recorded for 2005. Using the estimated City population of 7,200 people from CDOLA, this equates to a residential per-capita usage of 74 gallons per capita per day (gpcd), a 3.8 persons-per tap ratio, and a water use of 0.3 ac-ft per tap – all of which seem out of line with industry standard values. Most planners expect a per-capita water use of 150 to 190 gpcd, estimate 2.8 to 2.9 persons per tap, and use 0.5 to 0.6 ac-ft per tap.

One source for the error is the difference between a "tap" and a Single Family Equivalent (SFE). The SFE concept provides a means to measure usage on an

"apples-to-apples" basis for different size taps. For example, Copper Key Village may physically consist of a single tap on the system, but in practice represents multiple users or SFE's of the system. We suspect that the 3.8 persons per tap is a direct reflection of a miscalculation of the SFE's within the system.

Although the 3.8 persons per tap ratio is very high, City staff believes the City will have a higher ratio of persons per tap due to the nature of its residents. In taking the analysis further, typical values of annual water use per household is generally expected to be 0.5 to 0.6 ac-ft, which includes outside irrigation. If the City has a higher person-per-tap ratio, logically the water use per tap should be equal to or slightly higher than this range. The current calculation is 0.3 ac-ft per tap. Another element of the City's action plan will be to figure out this discrepancy.

Another part of this discrepancy is related to the fact that the City does not know the number of multi-family or apartment units, or SFE's per tap. Typically, water use for multi-family is estimated by determining its proportionate share of an SFE, which is approximately 0.8 ac-ft per multi-family unit. Since the City does not know the number of multi-family or apartment units per tap, the numbers are inaccurate.

Due to the "out-of-norm" numbers, assumptions were made to project residential water demand. The persons-per-tap was reduced from 3.8 to 3.1 from 2007 through 2030. In addition, a 0.6 ac-ft per tap water use is used. These projections result in a residential per-capita water use of 173 gpcd.

Table 4.2 utilizes these planning numbers in combination with predicted growth to estimate future residential water demand.

Table 4.2 – Projected Residential Water Demand

Year	Estimated Population	Population Growth Rate (%)	Persons Per SFE	No. of SFE's	Per SFE Water Use (ac-ft/SFE)	Residential Water Usage (gal)	Residential Water Usage (ac-ft)	GPCD
2006	7200	3.0%	3.8	1920	0.60	375,380,352	1,152	143
2007	7416	3.0%	3.1	2392	0.60	467,711,810	1,435	173
2008	7638	3.0%	3.1	2464	0.60	481,743,164	1,478	173
2009	7868	3.0%	3.1	2538	0.60	496,195,459	1,523	173
2010	8104	3.0%	3.1	2614	0.60	511,081,323	1,568	173
2011	8347	3.0%	3.1	2693	0.60	526,413,762	1,616	173
2012	8597	3.0%	3.1	2773	0.60	542,206,175	1,664	173
2013	8855	3.0%	3.1	2856	0.60	558,472,360	1,714	173
2014	9121	3.0%	3.1	2942	0.60	575,226,531	1,765	173
2015	9394	3.0%	3.1	3030	0.60	592,483,327	1,818	173
2016	9676	3.0%	3.1	3121	0.60	610,257,827	1,873	173
2017	9966	3.0%	3.1	3215	0.60	628,565,562	1,929	173
2018	10265	3.0%	3.1	3311	0.60	647,422,529	1,987	173
2019	10573	3.0%	3.1	3411	0.60	666,845,204	2,046	173
2020	10891	3.0%	3.1	3513	0.60	686,850,561	2,108	173
2021	11217	3.0%	3.1	3619	0.60	707,456,077	2,171	173
2022	11554	3.0%	3.1	3727	0.60	728,679,760	2,236	173
2023	11901	3.0%	3.1	3839	0.60	750,540,152	2,303	173
2024	12258	3.0%	3.1	3954	0.60	773,056,357	2,372	173
2025	12625	3.0%	3.1	4073	0.60	796,248,048	2,444	173
2026	13004	3.0%	3.1	4195	0.60	820,135,489	2,517	173
2027	13394	3.0%	3.1	4321	0.60	844,739,554	2,592	173
2028	13796	3.0%	3.1	4450	0.60	870,081,740	2,670	173
2029	14210	3.0%	3.1	4584	0.60	896,184,193	2,750	173
2030	14636	3.0%	3.1	4721	0.60	923,069,718	2,833	173

The total residential water usage is projected to reach 2,833 ac-ft by 2030.

Commercial/Industrial Water Demand

The City Planner estimates Commercial/Industrial water demand within the City to grow at two new taps per year. In order to accurately project demands associated with this customer category, it is important to note that Thermo and Golden Aluminum currently account for 1,241 ac-ft of the total 1,310 ac-ft. Accordingly, Thermo and Golden Aluminum were separated from the total use and projected separately. Water use per tap for this customer category is projected at 140,000 gallons. Thermo and Golden Aluminum uses were projected to increase at 1% annually.

Table 4.3 – Projected Commercial/Industrial Water Demand

Year	No. of Comm/Ind Taps	No. of Comm/Ind Taps w/o Thermo and Golden Aluminum	Comm/Ind Per Tap Usage (gal/tap)	Comm/Ind Per Tap Usage w/o Thermo and Golden Aluminum (gal)	Comm/Ind Per Tap Usage w/o Thermo and Golden Aluminum (ac-ft)	Thermo and Golden Aluminum Water Usage (ac-ft)	Total Comm/Ind Water Usage (ac-ft)
2006	164	162	140,000	22,680,000	70	1,241	1311
2007	166	164	140,000	22,960,000	70	1,254	1325
2008	168	166	140,000	23,240,000	71	1,268	1339
2009	170	168	140,000	23,520,000	72	1,281	1353
2010	172	170	140,000	23,800,000	73	1,295	1368
2011	174	172	140,000	24,080,000	74	1,309	1383
2012	176	174	140,000	24,360,000	75	1,323	1398
2013	178	176	140,000	24,640,000	76	1,337	1413
2014	180	178	140,000	24,920,000	76	1,351	1428
2015	182	180	140,000	25,200,000	77	1,366	1443
2016	184	182	140,000	25,480,000	78	1,380	1459
2017	186	184	140,000	25,760,000	79	1,395	1474
2018	188	186	140,000	26,040,000	80	1,410	1490
2019	190	188	140,000	26,320,000	81	1,425	1506
2020	192	190	140,000	26,600,000	82	1,440	1522
2021	194	192	140,000	26,880,000	82	1,456	1538
2022	196	194	140,000	27,160,000	83	1,471	1555
2023	198	196	140,000	27,440,000	84	1,487	1571
2024	200	198	140,000	27,720,000	85	1,503	1588
2025	202	200	140,000	28,000,000	86	1,519	1605
2026	204	202	140,000	28,280,000	87	1,535	1622
2027	206	204	140,000	28,560,000	88	1,552	1639
2028	208	206	140,000	28,840,000	89	1,568	1657
2029	210	208	140,000	29,120,000	89	1,585	1675
2030	212	210	140,000	29,400,000	90	1,602	1692

The estimated water use for Commercial/Industrial is expected to reach 1,692 ac-ft by 2030.

School Water Demand

Currently, there is one high school, one middle school and two elementary schools within the City of Fort Lupton. It is anticipated that there will be one additional school built within the 2030 planning horizon. The water demand for Schools is projected at 1.0 MG of use per tap.

Table 4.4 – Projected School Water Demand

Year	No. of School Taps	School Per Tap Usage (gal/tap)	School Water Usage (gal)	School Water Usage (ac-ft)
2006	4	1,000,000	4,000,000	12
2007	4	1,000,000	4,000,000	12
2008	4	1,000,000	4,000,000	12
2009	4	1,000,000	4,000,000	12
2010	4	1,000,000	4,000,000	12
2011	4	1,000,000	4,000,000	12
2012	4	1,000,000	4,000,000	12
2013	4	1,000,000	4,000,000	12
2014	4	1,000,000	4,000,000	12
2015	4	1,000,000	4,000,000	12
2016	4	1,000,000	4,000,000	12
2017	4	1,000,000	4,000,000	12
2018	4	1,000,000	4,000,000	12
2019	4	1,000,000	4,000,000	12
2020	5	1,000,000	5,000,000	15
2021	5	1,000,000	5,000,000	15
2022	5	1,000,000	5,000,000	15
2023	5	1,000,000	5,000,000	15
2024	5	1,000,000	5,000,000	15
2025	5	1,000,000	5,000,000	15
2026	5	1,000,000	5,000,000	15
2027	5	1,000,000	5,000,000	15
2028	5	1,000,000	5,000,000	15
2029	5	1,000,000	5,000,000	15
2030	5	1,000,000	5,000,000	15

School usage is projected to reach 15 ac-ft by 2030. School usage is indoor use only, as outside irrigation at the schools is included in the City irrigation customer category.

Multi-Family Water Demand

Multi-Family water use is projected to grow at five new units per year, which is reasonable according to the City Planner. A per-unit use of 140,000 gallons per multi-family unit is used to project water demand in this customer category.

Table 4.5 – Projected Multi-Family Water Demand

Year	No. of Multi-Family Units	Multi-Family Per Unit Usage (gal/Unit)	Multi-Family Water Usage (gal)	Multi-Family Water Usage (ac-ft)
2006	119	140,000	16,660,000	51
2007	119	140,000	16,660,000	51
2008	124	140,000	17,360,000	53
2009	129	140,000	18,060,000	55
2010	134	140,000	18,760,000	58
2011	139	140,000	19,460,000	60
2012	144	140,000	20,160,000	62
2013	149	140,000	20,860,000	64
2014	154	140,000	21,560,000	66
2015	159	140,000	22,260,000	68
2016	164	140,000	22,960,000	70
2017	169	140,000	23,660,000	73
2018	174	140,000	24,360,000	75
2019	179	140,000	25,060,000	77
2020	184	140,000	25,760,000	79
2021	189	140,000	26,460,000	81
2022	194	140,000	27,160,000	83
2023	199	140,000	27,860,000	85
2024	204	140,000	28,560,000	88
2025	209	140,000	29,260,000	90
2026	214	140,000	29,960,000	92
2027	219	140,000	30,660,000	94
2028	224	140,000	31,360,000	96
2029	229	140,000	32,060,000	98
2030	234	140,000	32,760,000	101

The 2030 water use for Multi-Family is estimated to reach 101 ac-ft.

Hotel/Motel Water Demand

The City Planner anticipates one new Hotel/Motel to be built within the City during our planning horizon out to 2030. An estimated per-tap usage of 700,000 gallons is used to project water demand for this customer category.

Table 4.6 – Projected Hotel/Motel Water Demand

Year	No. of Hotel/Motel Taps	Hotel/Motel Per Tap Usage (gal/tap)	Hotel/Motel Water Usage (gal)	Hotel/Motel Water Usage (ac-ft)
2006	3	700,000	2,100,000	6
2007	3	700,000	2,100,000	6
2008	3	700,000	2,100,000	6
2009	3	700,000	2,100,000	6
2010	3	700,000	2,100,000	6
2011	3	700,000	2,100,000	6
2012	3	700,000	2,100,000	6
2013	3	700,000	2,100,000	6
2014	3	700,000	2,100,000	6
2015	3	700,000	2,100,000	6
2016	3	700,000	2,100,000	6
2017	3	700,000	2,100,000	6
2018	3	700,000	2,100,000	6
2019	3	700,000	2,100,000	6
2020	4	700,000	2,800,000	9
2021	4	700,000	2,800,000	9
2022	4	700,000	2,800,000	9
2023	4	700,000	2,800,000	9
2024	4	700,000	2,800,000	9
2025	4	700,000	2,800,000	9
2026	4	700,000	2,800,000	9
2027	4	700,000	2,800,000	9
2028	4	700,000	2,800,000	9
2029	4	700,000	2,800,000	9
2030	4	700,000	2,800,000	9

Hotel/Motel usage is estimated at 9 ac-ft by 2030.

City Irrigation Water Demand

The City Planner anticipates five new parks to be constructed by 2030, either by the City or through development annexation. A per-tap usage of 6.0 MG is used to project this water demand forward. Typically a per-acre calculation better suits City irrigation water demand projections. The City is in the midst of completing a 2007 Comprehensive Plan update, which will identify future City irrigation. Future updates of this Water Conservation Plan will adjust this projection when more data is available.

Table 4.7 – Projected City Irrigation Water Demand

Year	No. of City Irrigation Taps	City Irrigation Per Tap Usage (gal/tap)	City Irrigation Water Usage (gal)	City Irrigation Water Usage (ac-ft)
2006	25	6,000,000	150,000,000	460
2007	25	6,000,000	150,000,000	460
2008	25	6,000,000	150,000,000	460
2009	26	6,000,000	156,000,000	479
2010	26	6,000,000	156,000,000	479
2011	26	6,000,000	156,000,000	479
2012	26	6,000,000	156,000,000	479
2013	26	6,000,000	156,000,000	479
2014	27	6,000,000	162,000,000	497
2015	27	6,000,000	162,000,000	497
2016	27	6,000,000	162,000,000	497
2017	27	6,000,000	162,000,000	497
2018	27	6,000,000	162,000,000	497
2019	28	6,000,000	168,000,000	516
2020	28	6,000,000	168,000,000	516
2021	28	6,000,000	168,000,000	516
2022	28	6,000,000	168,000,000	516
2023	28	6,000,000	168,000,000	516
2024	29	6,000,000	174,000,000	534
2025	29	6,000,000	174,000,000	534
2026	29	6,000,000	174,000,000	534
2027	29	6,000,000	174,000,000	534
2028	29	6,000,000	174,000,000	534
2029	30	6,000,000	180,000,000	552
2030	30	6,000,000	180,000,000	552

City irrigation is projected to be 552 ac-ft in 2030.

Total Future Water Demand

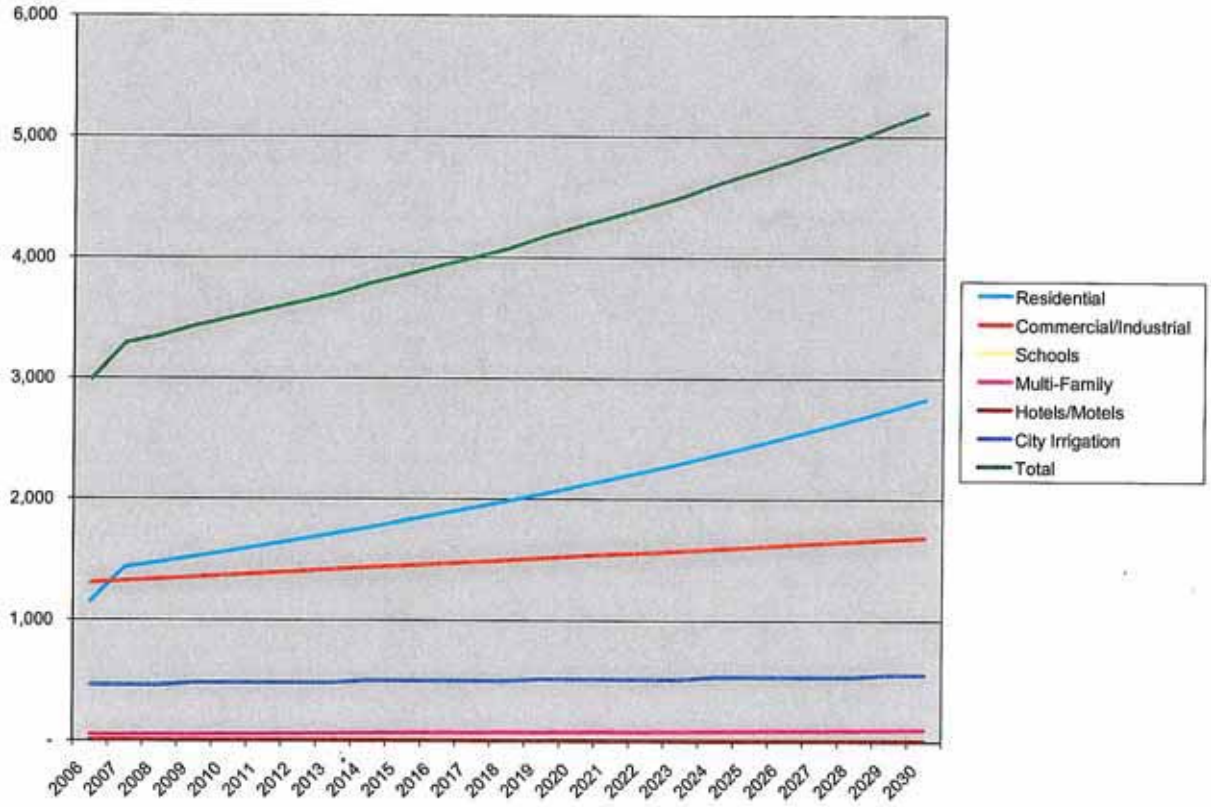
The total projected water demand is summarized below.

Table 4.8 – Total Projected Future Water Demand (Potable + Non-Potable)

Year	Residential Water Usage (ac-ft)	Comm/Ind Water Usage (ac-ft)	School Water Usage (ac-ft)	Multi-Family Water Usage (ac-ft)	Hotel/Motel Water Usage (ac-ft)	City Irrigation Water Usage (ac-ft)	Total Water Usage (ac-ft)
2006	1,152	1,311	12	51	6	460	2,993
2007	1,435	1,325	12	51	6	460	3,290
2008	1,478	1,339	12	53	6	460	3,350
2009	1,523	1,353	12	55	6	479	3,429
2010	1,568	1,368	12	58	6	479	3,492
2011	1,616	1,383	12	60	6	479	3,555
2012	1,664	1,398	12	62	6	479	3,621
2013	1,714	1,413	12	64	6	479	3,688
2014	1,765	1,428	12	66	6	497	3,775
2015	1,818	1,443	12	68	6	497	3,846
2016	1,873	1,459	12	70	6	497	3,918
2017	1,929	1,474	12	73	6	497	3,992
2018	1,987	1,490	12	75	6	497	4,067
2019	2,046	1,506	12	77	6	516	4,164
2020	2,108	1,522	15	79	9	516	4,248
2021	2,171	1,538	15	81	9	516	4,330
2022	2,236	1,555	15	83	9	516	4,414
2023	2,303	1,571	15	85	9	516	4,500
2024	2,372	1,588	15	88	9	534	4,606
2025	2,444	1,605	15	90	9	534	4,696
2026	2,517	1,622	15	92	9	534	4,789
2027	2,592	1,639	15	94	9	534	4,884
2028	2,670	1,657	15	96	9	534	4,981
2029	2,750	1,675	15	98	9	552	5,100
2030	2,833	1,692	15	101	9	552	5,202

The total water demand in 2030 is estimated to be 5,200 ac-ft. This is an increase of 2,200 ac-ft from current demands.

Figure 4.3 – Total Projected Future Water Demand (Potable + Non-Potable)



Average-Day and Max-Day Capacity Demands

Equally important to the water demand projections are system capacity demands. Thus, as part of the demand forecasting, the delivery capacity needs were analyzed.

The City of Fort Lupton's raw water supply is from two sources. Alluvial wells supply water for irrigation, Thermo and CGH and the CBT system is the source for potable water. Currently, the City has an allotment of 8 cfs or 5.2 MGD of CBT/Windy Gap water from Carter Lake. This mountain supply pipeline is operated by NCWCD.

The original WTP had a nominal capacity of 3.0 MGD. Due to backwashing operations, cleanings, etc., each filter has an actual throughput of approximately 0.86 MGD. The original throughput capacity was approximately 2.6 MGD through three filters. The Town of Hudson owned 1/6th of this original capacity. To keep up with demands in the City, the WTP was expanded in 2001. The design capacity of the expanded plant is a nominal 5.0 MGD via five micro-filter units with a throughput equal to 4.3 MGD. The average annual demand for 2005 was 1.3 MGD with a current max-day demand of 2.9 MGD.

The plant is generally run on a continuous basis. For the months of October through May, the number of units online is limited to two or three units with the net production capacity reduced to meet the lower water demands during the off-peak season. This is accomplished by the use of variable speed pumps on the plant supply line that adjust the flow rates to the filters to meet projected water demands for the day. During the months of June through September, the number of micro-filtration units online typically varies from three to four with continuous plant operations 24 hours a day.

Assuming the current population is 7,200 persons and maximum-day flow is 2.9 MGD, the calculated maximum-day-per-capita flow is 403 gpcd. In the future, we expect to see a slight reduction in these values. For planning purposes, the maximum-day-per-capita flows are anticipated to be in the range of 375 gpcd by 2030. Based on 3% annual growth and the planning numbers presented herein, we estimate the current WTP will have adequate capacity until City demands equal 3.87 MGD (4.5 filters at 0.86 MGD per filter) or until 2016. At that point in time, we anticipate replacing the filters with higher efficiency filters, adding two additional filters and constructing a backwash recovery system. This will increase the capacity of each filter to approximately 0.9 MGD. Thus, the City should anticipate a filtration capacity of 6.5 micro-filters at 0.9 MGD per filter for a total capacity of 5.85 MGD.

The scheduling of water system improvements to meet water demands for the projected number of taps is very dependent upon the projected population growth rate, actual water usage and existing system limitations. A high population growth rate or high water usage rate per tap will require the expansion of the water system improvements over a shorter period of time whereas a low population growth rate or low water usage rate per tap allows the improvements to be phased over a longer period of time.

Potential Facility Needs

Raw Water Storage

Mountain water from the Southern Water Supply Pipeline is gravity fed to the City WTP via a 20-inch transmission line, owned and operated by NCWCD. Currently, the City has a right to convey a peak flow equal to 9.6 cfs (6.2 MGD), of which Hudson owns 1/6th (1.6 cfs or 1.0 MGD). The water is either stored in a 0.5-MG raw water tank at the WTP or fed directly into the WTP feed well. This 0.5 MG, under current max-day demands, represents approximately four hours of raw water storage. The limited amount of available mountain water storage at the WTP presents some concern. For example, if the Southern Water Supply Pipeline experiences a shutdown, break or other emergency along its multi-mile route, the City of Fort Lupton and Hudson will have a minimal water supply to feed the plant. This problem will be exacerbated as the treatment plant capacity is increased, i.e. the amount of emergency-reserve time operators can feed the system will decrease.

At a minimum, we recommend the WTP have at least two to three days of mountain water storage capacity to provide a supply of water to residents during emergencies and routine maintenance of the NCWCD pipeline. The most cost-effective means to provide this storage is through an online or offline storage reservoir. To provide three days of storage at 9.6 cfs requires a 60 ac-ft reservoir. However, there needs to be a sufficient "dead pool" of water in the reservoir to maintain sufficient water quality. Thus, we recommend the City prioritize the construction of a 100 ac-ft reservoir at the WTP.

Table 5.1 – 100 ac-ft Mountain Water Storage Reservoir, Opinion of Probable Construction Costs

Item	Quantity	Unit	Unit Cost	Item Cost
Mob/Demob and general contract requirements	1	LS	$50,000	$50,000
Miscellaneous demolition and removal	1	LS	$50,000	$50,000
Land Acquisition	20	acres	$20,000	$400,000
Reservoir earthwork, lining, sitework	100	Ac-ft	$3,000	$300,000
Telemetry system	1	LS	$50,000	$50,000
Transfer pumps and piping	1	LS	$200,000	$200,000
Subtotal				$1,050,000
Design and Construction Contingencies (20%)				$210,000
Contractors Overhead and Profit (15%)				$157,500
Construction Cost Subtotal				$1,417,500
Engineering - Design Phase Services (8%)				$113,400
Engineering - Construction Phase Services (4%)				$56,700
Total				**$1,587,600**

The City will need to evaluate the ideal size of storage to construct considering the ultimate location and financial capabilities at the time. There is expected to be an economies-of-scale savings in constructing a larger reservoir. The City can also cost share with the Town of Hudson.

Treatment Plant Expansion

One of the City's goals is to increase the WTP efficiency. More specifically, the existing WTP does not recover 7.5% to 8% of the raw water entering the plant. By definition, efficiency used herein is the amount of water delivered to customers following treatment divided by the amount of raw water coming into the plant. In simpler terms, 92 to 92.5 out of every 100 gallons delivered to the WTP gets delivered to customers. This inefficiency impacts all phases of the City's water and wastewater utilities from raw water supply through wastewater treatment. We recommend the City strive to increase this efficiency to 98%.

The impact of increasing the efficiency of the WTP is significant in virtually every aspect of the City's water and wastewater utilities. To fully realize these benefits, the City must have a filter unit dedicated to recovering the water currently being sent to the WWTP. This will require the City to construct a separate backwash recovery system.

To determine when the next WTP expansion is required, we have assumed the City has four and a half filter units available, with a total net production capability of 3.87 MGD (five filters at 0.86 MGD less 0.43 MGD to the Town of Hudson). Accordingly, at a 3% population growth rate as assumed throughout this study, the City will need additional filtration capacity within the next ten years. We have recommended the City install two additional two filter units before 2016. The piping for this project was planned for in the last plant expansion.

Table 5.2 – WTP Expansion, Opinion of Probable Construction Costs

Item	Quantity	Unit	Unit Cost	Item Cost
Mob/Demob and general contract requirements	1	LS	$50,000	$50,000
Earthwork, grading and misc. sitework	1	LS	$100,000	$100,000
Valve and piping modifications (existing filters)	1	LS	$50,000	$50,000
Process piping and valves for new filters	1	LS	$200,000	$200,000
90M10C units	2	LS	$300,000	$600,000
Electrical, controls and instrumentation	1	LS	$150,000	$150,000
Plant SCADA / PLC control system upgrades	1	LS	$40,000	$40,000
Telemetry system improvements	1	LS	$15,000	$15,000
Backwash recovery system	1	LS	$750,000	$750,000
Subtotal				$1,955,000
Design and Construction Contingencies (20%)				$391,000
Contractors Overhead and Profit (15%)				$293,250
Construction Cost Subtotal				$2,639,250
Engineering - Design Phase Services (8%)				$211,140
Engineering - Construction Phase Services (4%)				$105,570
Total				**$2,955,960**

Recognizing that the City may not be able to acquire the funds to complete this project by 2016, the City will evaluate other options that may be available to minimize the wasting of backwash water. Other options could include a temporary backwash recovery system and potential lease of backwash water to interested third parties (i.e. Thermo) or the City itself - pending contractual, water rights, water quality and other issues.

In addition, the City will continue to monitor the performance of the WTP filters. As their capacity decreases over time, the City may need a WTP expansion or filter upgrade before 2016.

Finished Water Storage and Distribution

The existing WTP has a finished-water clear well volume of approximately 83,920 gallons. Water exits the clear well through 12-inch and 20-inch pipelines to Hudson and Fort Lupton, respectively. Water from Fort Lupton's 20-inch pipeline flows to a 3-MG tank. Upon leaving the 3-MG tank, water is fed to two 1-MG storage tanks located within the City's Low Zone storage tank at the tank farm. Currently, there are no customers tapping off of the 20-inch pipeline. Thus, the City has a total of 5 MG of finished water storage.

This provides adequate storage through 2030. However, to accommodate planned future growth, the City's Urban Growth Area will require servicing customers outside of existing service areas. To accommodate this growth, the City will need an additional above-ground storage facility to serve customers at elevations higher than the High Pressure Zone can service. This new Zone has been informally labeled the "Jesser-Brown" pressure zone. Providing service to this zone will also require approximately two miles of 16-inch pipe, a new pump station and modifications to an existing pump station and the distribution system.

Table 5.3 – Transmission, Distribution and Storage Improvements, Opinion of Probable Construction Costs

Item	Quantity	Unit	Unit Cost	Item Cost
Mob/Demob and general contract requirements	1	LS	$50,000	$50,000
Land Acquisition	1	acre	$20,000	$20,000
Earthwork, grading and misc. sitework	1	LS	$100,000	$100,000
New 1 MG Steel Tank	1	LS	$900,000	$900,000
Electrical, controls and instrumentation	1	LS	$50,000	$50,000
16" Pipeline	10,000	LF	$75	$750,000
Piping Reconfigurations	1	LS	$50,000	$50,000
Existing Pump Station Modifications	1	LS	$150,000	$150,000
New Pump Station	1	LS	$50,000	$50,000
Plant SCADA / PLC control system upgrades	1	LS	$40,000	$40,000
Telemetry system improvements	1	LS	$15,000	$15,000
Subtotal				$2,175,000
Design and Construction Contingencies (20%)				$435,000
Contractors Overhead and Profit (15%)				$326,250
Construction Cost Subtotal				$2,936,250
Engineering - Design Phase Services (8%)				$234,900
Engineering - Construction Phase Services (4%)				$117,450
Total				**$3,288,600**

Water Rights Purchase

The City will need to purchase an additional four shares of Windy Gap and 110 shares of Fulton Ditch by 2030, per recommendations from the 2003 Raw Water Master Plan. The estimated costs of these water rights purchases are shown in the following table.

Table 5.4 – Water Rights Purchase Costs

Water Right	Number of Shares Needed	Consumptive Use Per Share (ac-ft)	Unit Cost ($/ac-ft CU)	Total Cost ($)
Fulton Ditch	110	1.75	$10,000	$1,925,000
Windy Gap	4	100	$18,000	$7,200,000
Total				**$9,125,000**

Fulton Ditch is estimated to cost $10,000 per ac-ft of consumptive use. Recent sales of Fulton Ditch shares have ranged from $15,000 to $18,000 per share.

Windy Gap is estimated at $9,000 per ac-ft. Since Windy Gap is junior to CBT and is not currently firmed, it is estimated that it will cost another $9,000 per ac-ft to firm the water right. One unit of Windy Gap equates to 100 ac-ft.

Augmentation Storage

The City will require both Fulton Ditch and Windy Gap effluent storage. Since the Fulton Ditch typically operates from April through October, having storage will allow the City to store excess Fulton Ditch credits during the irrigation season and divert the water back to the river in the winter months or other times of need. Under current projections, the City will need 200 ac-ft of Fulton Ditch storage. The City has received 100 ac-ft through an agreement with a developer building a storage reservoir and has the option to purchase another 100 ac-ft within the same storage vessel.

Table 5.5 – Fulton Ditch Storage, Opinion of Probable Construction Costs

Item	Quantity	Unit	Unit Cost	Item Cost
Mob/Demob and general contract requirements	1	LS	$50,000	$50,000
Earthwork, grading and misc. sitework	1	LS	$50,000	$50,000
Raw Water Storage	100	ac-ft	$2,500	$250,000
Subtotal				$350,000
Design and Construction Contingencies (20%)				$70,000
Contractors Overhead and Profit (15%)				$52,500
Construction Cost Subtotal				$472,500
Engineering - Design Phase Services (8%)				$37,800
Engineering - Construction Phase Services (4%)				$18,900
Total				**$529,200**

The City will also need 500 ac-ft of Windy Gap effluent storage. This storage allows the City to maximize the reusable component of the Windy Gap water right. The City is presently negotiating 100 ac-ft with a developer. If the City is successful, the City will need to purchase an additional 400 ac-ft of effluent storage.

Table 5.6 – Windy Gap Effluent Storage, Opinion of Probable Construction Costs

Item	Quantity	Unit	Unit Cost	Item Cost
Mob/Demob and general contract requirements	1	LS	$100,000	$100,000
Earthwork, grading and misc. sitework	1	LS	$50,000	$50,000
Raw Water Storage	400	ac-ft	$3,500	$1,400,000
Subtotal				$1,550,000
Design and Construction Contingencies (20%)				$310,000
Contractors Overhead and Profit (15%)				$232,500
Construction Cost Subtotal				$2,092,500
Engineering - Design Phase Services (8%)				$167,400
Engineering - Construction Phase Services (4%)				$83,700
Total				**$2,343,600**

The City potentially could use one of its wastewater lagoons to develop storage. Storage at this location is ideal because the water can be gravity fed from the WWTP to the storage vessel and subsequently released by gravity to the river. It is estimated that 80 ac-ft of storage could be built at the WWTP lagoons.

Table 5.7 – Windy Gap Effluent Storage at WWTP, Opinion of Probable Construction Costs

Item	Quantity	Unit	Unit Cost	Item Cost
Mob/Demob and general contract requirements	1	LS	$100,000	$100,000
Earthwork, grading and misc. sitework	1	LS	$50,000	$50,000
Raw Water Storage	80	ac-ft	$1,800	$144,000
Subtotal				$294,000
Design and Construction Contingencies (20%)				$58,800
Contractors Overhead and Profit (15%)				$44,100
Construction Cost Subtotal				$396,900
Engineering - Design Phase Services (8%)				$31,752
Engineering - Construction Phase Services (4%)				$15,876
Total				**$444,528**

CHAPTER 6 – CONSERVATION GOALS

Water Conservation Goals

In review of the water demands and costs shown above, the City of Fort Lupton recognizes the need to further develop its water conservation goals. The three largest users within the City are Residential, Thermo and City Irrigation. Goals were established for these three users through discussions with City staff and cooperation with customers within these categories.

Residential

The City's residential per-capita water usage is 173 gpcd. One goal is to reduce this per-capita water usage to 161 gpcd. This water savings can be measured by dividing the total water usage by the current population as the City moves into the future. However, a key component of this is to get a good handle on the billing records. The discrepancy from what is measured leaving the WTP versus what is measured at the individual service meters is currently too high. It is important that the City work to improve the unaccounted-for water because it is difficult to track water use and may be a source of unrealized revenue. Once these discrepancies are resolved, this water savings can be measured.

The City targets a 10-year reduction of 5% and a long-term reduction of 7%. If Table 4.2 is revised accordingly, the 2016 water demand is reduce from 1,873 ac-ft to 1,742 ac-ft or 131 ac-ft. The 2030 projected water demand is reduced from 2,833 ac-ft to 2,639 ac-ft. This is a long-term target water savings of 194 ac-ft or 7%.

Thermo

Thermo is a very large Commercial/Industrial user in the City. Current water use at the power plant is measured only by Thermo at the end of the pipeline from the 1-MG well water tank at the tank farm. Since Thermo's water usage is 39% of the City's total water usage (potable + non-potable) and 86% of the City's well water usage, conservation at the power plant would be beneficial.

The City met with Thermo to ascertain possible water conservation measures at the power plant. Thermo significantly reduced its water usage in 2002 by improving operations at the plant. The primary change, which involved renegotiation of Thermo's contract with Excel Energy, was to correlate electricity production with demands. Thermo reduced its water use from an average of 938,000 gallons per day to 586,000 gallons per day, or 38%. As suggested earlier in this report, the City would also like to evaluate if the backwash water from the WTP could also be included in Thermo's raw water acquisition program.

Use of backwash waste at Thermo would reduce the amount of well water pumped from the City wells in addition to reducing the augmentation required. In an effort to evaluate further water savings options, Thermo has provided costs indicating the best available technologies to reduce water demand, as provided later in this report. Unfortunately, the cost-benefit ratios indicate that Thermo is doing everything practical to reduce its water usage. As a result, we do not believe that Thermo will be able to significantly reduce its water usage further.

Thermo's water use is currently being metered only at the power plant. As part of the City's water conservation efforts, the City will install meters at the front end of the pipeline as a point of redundancy to verify Thermo's water use. The smallest inaccuracy on such a large water user can lead to much revenue lost in billings and much more capital spent on augmentation. For example, we estimate that over the last three years, there has been approximately $103,000 in lost water billing revenue associated with Thermo.

City Irrigation

City irrigation totals 460 ac-ft. This water use comes from well water, so water conservation for City irrigation has a large benefit. Less well pumping means less water usage and associated augmentation. Irrigation of the golf course accounts for 310 ac-ft of the total 460 ac-ft, or 67% of the total City irrigation. The golf course, parks and open space are for the public's enjoyment, so keeping them green is important to the City. The City also recognizes its role in maximizing the effectiveness of water usage for irrigation.

The City met with the management company for the golf course to collaborate on possible water savings. The City will target a water use reduction of 5% in City irrigation. This goal equates to a water savings target of 25 ac-ft by 2016 and 28 ac-ft by 2030. City irrigation is metered, and thus this water conservation can be quantified.

Goal Development Process

The goal development process was collaborative with City staff and officials. A meeting was initially held with City staff to discuss water conservation goals appropriate for the City. The largest water demand areas were evaluated to determine where potential conservation could be implemented. Once the largest users were identified, water conservation goals were established based on what had the largest impact and would have the highest probability of success, considering all factors such as costs, control and public acceptance. Research was performed on what other municipalities were targeting for water conservation to ensure the City of Fort Lupton's goals were reasonable. In addition, City staff and Clear Water Solutions contacted the largest water users and met with each individually to discuss goals that were realistic and would be true savings of water for the City and region. The largest water users within the City, namely Thermo and Coyote Creek Golf Course, know their operations best, so we worked collaboratively with these customers to develop conservation goals.

CHAPTER 7 – CONSERVATION MEASURES AND PROGRAMS

Water Conservation Measures and Programs

The City developed a universal list of conservation measures and programs that could be implemented. The list of measures and programs that were considered are as follows:

- Converting irrigated acreage to Xeriscape
- Increase WTP efficiency or finding beneficial use for backwash water
- Rebates for rainfall and wind sensors
- Rebates for low-flow fixtures – toilets, showerheads, faucets, and clothes washers
- Water reuse
- Leak identification and repair
- Removal of phreatophytes
- Water-savings demonstrations including school programs
- Water facility tours
- Water bill informational inserts
- Rate structure changes
- Requiring open space with new developments to be natural areas
- City-wide watering restrictions
- Revision of water bill to make it more understandable and informative
- Turf restrictions
- Irrigation equipment improvements at parks, schools, open space areas, and golf course
- Replace turf with concrete at golf course
- Inject wetting agent at golf course
- Place wind and rain sensors at parks, schools, open space areas, and golf course to avoid irrigation during high winds and/or rain
- Improve billing meters
- Irrigation equipment improvements at residences and businesses including residential sub-surface irrigation systems

Screening Criteria

Each conservation measure and program was evaluated considering the following criteria:

1. Benefit-cost of implementation
2. Public acceptance
3. Staff and Council approval

Screening of Conservation Measures and Programs

The water conservation measures and programs were screened to determine which ones would be evaluated further in the planning process. Each measure/program is described below with brief explanations of reasons they were/were not selected.

Converting irrigated acreage to Xeriscape

The City Council has expressed its interests in utilizing Xeriscape and other similar water conservation measures to preserve water supplies. However, at this time, the City will not provide incentives such as water dedication breaks for Xeriscape. If the City requires less water dedication for Xeriscape landscaping, and that Xeriscape eventually gets converted to irrigated landscape by new home or business owners, the City is left holding the bag. Although the City is not against Xeriscape, it currently does not have a policy to administer this program. Thus, the City will not consider this option further at this time.

Increase WTP efficiency or finding beneficial use for backwash water

This measure requires upgrades to the City's WTP to either increase the efficiency from approximately 93% to 98% or to find other beneficial uses for the backwash water. By implementing this measure, the City's entire water and wastewater utilities benefit. The City will consider this option further.

Rebates for rainfall and wind sensors

This program would provide rebates to residential users who would purchase rainfall or wind sensors for their sprinkler system. The sensor would shut down the irrigation system when it is raining or windy. Denver Water provides a $25 rebate for the installation of rainfall sensors. The City will evaluate this program further.

Rebates for low-flow fixtures – toilets, showerheads, faucets, and clothes washers

This program would provide rebates to residential users who would purchase low-flow fixtures to replace higher water-use models of toilets, showerheads, faucets, and washing machines. For example, Denver Water provides the following rebates.

Rebate	***Amount***
High-Efficiency Clothes Washers	$200
High-Efficiency Toilets	$125
Low-Flow Toilets	$25

Although cost could potentially make this prohibitive, the City will evaluate this program further.

Water reuse

The City has reusable Windy Gap effluent that returns to the river through its WWTP. Reuse cannot be considered at this point because all of the effluent is being used for augmentation. In the future, the City will consider reuse of fully consumable effluent for irrigation or other uses if the water is available beyond its augmentation needs. This program will not be evaluated any further.

Leak identification and repair

The City is very open to identifying leaks in the distribution system and repairing them, and this program will be evaluated further to determine its benefit-cost.

For residential leaks from fixtures, the City has a program to where if notified, Public Works staff will go to the residence to repair the leak.

Removal of phreatophytes

The City does not have existing phreatophyte areas, such as large cottonwood trees, where removal would benefit in water savings. In addition, there would be public resistance in the implementation of this program. This conservation program will not be considered further.

Water-savings demonstrations including school programs

The City encourages water savings through education, so this will be considered further. The City will further evaluate presenting water-savings demonstrations to the public. As part of this, the City will include school programs to teach kids the importance of water conservation.

Water facility tours

The City has an on-going program to provide water facility tours to the general public to teach how water is treated and delivered and to provide a concept of the costs associated with water treatment and delivery. The City is committed to this program and will evaluate if additional tours may be of benefit in its water conservation goals.

Water bill informational inserts

The City likes this program because it is low cost and is very informative to its customers. The City has performed some information inserts in water bills in the past and will evaluate this program further.

Rate structure changes

The City is currently evaluating its rate structure and rates on an annual basis, comparing them to fixed costs, and making adjustments as necessary. As part of this program, the City will evaluate commercial rates to determine if they are keeping up with the costs to deliver water. Appropriate changes will be made as necessary, and thus this program will be evaluated further in the planning process.

Requiring open space with new developments to be natural areas

The City does not want to require this program at this time. It would entail new development annexing into the City to leave open space areas as natural areas. This program will not be evaluated further.

City-wide watering restrictions

The City is amenable to mandatory watering restrictions if the benefit and cost make sense for the City. This conservation program will be evaluated further.

Revision of water bill to make it more understandable and informative

The City has made an effort to keep its water bills simple and easy to understand for its customers. There are other alternatives that would be more beneficial for water conservation. No improvements will be made to the water bill at this time, and thus this measure will not be considered further.

Turf restrictions

There would be much resistance to this water conservation measure. The measure would establish restrictions on the amount of turf that could be planted with new development. The City will not evaluate this alternative further.

Irrigation equipment improvements at parks, schools, open space areas, and golf course

As irrigation continues at the parks, schools, open space areas, and golf course, the equipment becomes less and less efficient; requiring more water to irrigated the same amount of ground. The City is open to a program to replace irrigation equipment, although cost could be a major factor. This program will be evaluated further.

Replace turf with concrete at golf course

In order to minimize costs when the golf course was first constructed, some of the golf cart paths were left as turf areas that are being irrigated. The City is open to connecting the cart path system with concrete, and thus reducing the amount of irrigated ground. Replacement of turf grass at the golf course will be evaluated further.

Inject wetting agent at golf course

The measure requires injecting a wetting agent into the ground, which assists in soil enhancement and improves the effectiveness of the water being applied. Wetting agents have been proven to help in watering practices and will be considered further in the planning process.

Place wind and rain sensors at parks, schools, open space areas, and golf course to avoid irrigation during high winds and/or rain

There are times when the automatic sprinkler systems will be set to water when it is raining or windy. The City will consider installing wind and rain sensors to shut down automated sprinkler systems during these times. Although this program may be cost prohibitive, it will be considered further.

Improve billing meters

This is an important measure to implement to quantify current water use. Currently, the City's billing data is inaccurate requiring assumptions to be made in current water use. This program will be evaluated further.

Irrigation equipment improvements at residences and businesses

Recent improvements in irrigation systems (including subsurface and drip irrigation systems) should decrease the amount of water required to irrigate a given land area. The City encourages residences and businesses to utilize best management practices when constructing new or replacing old irrigation systems. However, the City feels that management of an incentive based system related to subsurface sprinkler or other similar type irrigation systems would be very problematic to administer. Accordingly, this program will not be evaluated further.

CHAPTER 8 – EVALUATION AND SELECTION

Combination of Water Conservation Measures and Programs

As part of the evaluation and selection process, the broad range of measures and programs previously identified in Chapter 7 to be evaluated further was broken into four major categories: Rebates and Incentives, Educational Programs, Regulatory Controls, and Utility Maintenance Programs.

Rebates and Incentives

- Rebates for rainfall and wind sensors
- Rebates for low-flow fixtures – toilets, showerheads, faucets, and clothes washers

Educational Programs

- Water-savings demonstrations
- School programs
- Water facility tours
- Water bill informational inserts

Regulatory Controls

- Rate structure changes
- City-wide watering restrictions

Utility Maintenance Programs

- Place wind and rain sensors at parks, schools, open space areas, and golf course to avoid irrigation during high winds and/or rain
- Increase water treatment plant efficiency
- Replace turf with concrete at golf course
- Injecting wetting agent at golf course
- Leak identification and repair
- Irrigation equipment improvement at parks, schools, open space areas, and golf course
- Improve billing meters

Estimate Costs and Water Savings of Conservation Options

The potential conservation options available to the City are separated into two main categories – potable and non-potable use.

Potable Use - Indoor Use Conservation Options

Prior to understanding potential inside use savings, it is important to first understand the magnitude of typical residential indoor use. Table 8.1.provides a

synopsis of a detailed study conducted by the American Water Works Association for typical indoor residential uses.

Table 8.1 – Residential Water Use by Fixture or Appliance[a,b]

Fixture/use	Gal/use: Average range	Uses/person/day: Average range	Gal/person/day: Average range[c]	% Total: Average range
Toilet	3.5 2.9-3.9	5.05 4.5-5.6	18.5 15.7-22.9	26.7 22.6-30.6
Shower	17.2[d] 14.9-18.6	0.75[d] 0.6-0.9	11.6 8.3-15.1	16.8 11.8-20.2
Bath	See shower	See shower	1.2 0.5-1.9	1.7 0.9-2.7
Clothes washer	40.5 —	0.37 0.30-0.42	15.0 12.0-17.1	21.7 17.8-28.0
Dishwasher	10.0 9.3-10.6	0.10 0.06-0.13	1.0 0.6-1.4	1.4 0.9-2.2
Faucets	1.4[e] —	8.1[f] 6.7-9.4	10.9 8.7-12.3	15.7 12.4-18.5
Leaks	NA	NA	9.5 3.4-17.6	13.7 5.3-21.6
Other Domestic	NA	NA	1.6 0.0-6.0	2.3 0.0-8.5
Total	NA	NA	69.3 57.1-83.5	100

[a]Results from AWWARF REUWS at 1,188 homes in 12 metropolitan areas. Homes surveyed were served by public water supplies, which operate at higher pressure than private water sources. Leakage rates might be lower for homes on private water supplies.
[b]Results are averages over range. Range is the lowest to highest average for 12 metropolitan areas.
[c]Gal/person/day might not equal gal/use multiplied by uses/person/day because of differences in the number of data points used to calculate means.
[d]Includes shower and bath.
[e]Gallons per minute.
[f]Minutes of use per person per day.

Source: Mayer et al., 1999.

In 1992, Congress passed the U.S. Energy Policy Act (EPACT) to establish national standards governing the flow capacity of showerheads, faucets, urinals, and toilets for the purpose of national energy and water conservation. Table 8.2 compares typical indoor water consumption before and after enactment of the water conservation measures shown.

Table 8.2 – Comparison of Flow Rates and Flush Volumes Before and After EPACT

Fixture	Fixtures installed prior to 1994 in gallons/minute (liters/second)	EPACT requirements (effective January, 1994)	Potential reduction in water used (%)
Kitchen faucet	3.0 gpm (0.19 L/s)	2.5 gpm (0.16 L/s)	16
Lavatory faucets	3.0 gpm (0.19 L/s)	2.5 gpm (0.16 L/s)	16
Showerheads	3.5 gpm (0.22 L/s)	2.5 gpm (0.16 L/s)	28
Toilet (tank type)	3.5 gal (13.2 L)	1.6 gal (6.1 L)	54
Toilet (valve type)	3.5 gal (13.2 L)	1.6 gal[a] (6.1 L)	54
Urinal	3.0 gal (11.4 L)	1.0 gal (3.8 L)	50
Source: Konen, 1995.			

These EPACT reduction standards, in combination with the Denver Water Department rebate costs, form the basis of our cost-benefit analysis for indoor water use reductions as shown in Table 8.3.

Potable Use – Outdoor Use Conservation Options

In addition, Table 8.3 also provides cost-benefit analysis for reductions in outdoor water use, leak reduction programs and other incentives to reduce outdoor use.

Non-Potable Use - Outdoor Use Conservation Options

Outdoor water use conservation within the City is divided into two categories: 1) Thermo and CGH, and 2) Parks, Schools, Open Spaces, and Coyote Creek Golf Course.

Table 8.3 - Potable Water Savings - Benefit/Cost Analysis

Conservation Measure		Total Cost to City			# of units	Total Annual Cost	Gallons Saved per Unit per Year	Estimated Water Saved per Year	Cost per Gallon Saved	Rank	Comments
		Rebate	Labor	Materials							
Rebates & Incentives											
Rebate for residential rainfall and wind sensors		$25	$0	$0	10	$250	2000	20,000	$0.0125	11	1/250 homes participate every year and each home saves 2% of their annual outside use
Rebate for low flow toilet		$25	$0	$0	240	$6,000	5470	1,312,800	$0.0046	5	1/20 homes participate each year. Each toilet uses 25 gallons per day and can reduce to 12.5 gallons per day (2 toilets per home)
Rebate for low flow showerhead		$10	$0	$0	240	$2,400	1778	426,720	$0.0056	7	1/20 homes anticipate each year. Each showerhead uses 18 gallons per day and can reduce use by 28% (2 showers per home)
Rebate for low flow faucets		$5	$0	$0	360	$1,800	637	229,320	$0.0078	9	Each person uses 10.9 gallons per day and can reduce usage by 16% (3 faucets per house)
Rebate for low flow clothes washers		$200	$0	$0	24	$4,800	6077	145,848	$0.0329	13	Each person uses 15 gallons per day and can reduce usage by 37%
Educational programs											
Water-savings demonstrations including school programs		$0	$1,500	$500	36	$2,000	10000	360,000	$0.0056	6	0.5% of population saves 5% of respective home usage
Water facility tours (2/year)		$0	$1,000	$0	10	$1,000	10000	100,000	$0.0100	10	Tour participants reduce overall water usage by 5%
Water bill inserts		$0	$500	$1,200	2400	$1,700	1000	2,400,000	$0.0007	1	Leaflets provide .5% reduction across board for all residents
Regulatory Controls											
City-wide watering restrictions		$0	$10,000	$0	2400	$10,000	2000	4,800,000	$0.0021	2	Restrictions provide 1% reduction to all residents
Rate structure changes		$0	$15,000	$0	2400	$15,000	2000	4,800,000	$0.0031	3	Rate structure changes provide 1% reduction for all residents
Utility Maintenance Programs											
Increase WTP efficiency		$0	$0	$0		$85,000		21,181,700	$0.0040	4	5% reduction across board
Leak identification and repair			$20,000	$10,000		$30,000		4,236,340	$0.0071	8	1% reduction in leaks in system costs = $10,000 for leak survey and $20,000 in labor and materials to fix leaks
Improve billing meters			$30	$50	120	$9,600	3,910	469,200	$0.0205	12	Assume 20% loss thru meter = 39,102 gallons per year or a loss in revenue of $152.89 per year. Actual reduction in use = 10% of metered loss

Total Estimated Cost	$79,750		
Total Estimated Water Savings	19,154,380	gal	5% savings on 1,380 ac-ft = 22,483,719 gallons
Total Estimated Cost per Gallon Saved	$0.0076		includes lost revenue at $3.43 per 1,000 gallons

Note: Green Programs are those the City will pursue immediately, yellow programs will be implemented over the long term and red programs will not be implemented

Thermo and CGH

Thermo is aware of the need to reduce water use and consumption. Since 2002, changes in operation of the plant have reduced water consumption by 38%. Water consumption prior to 2002 averaged 938,000 gallons per day. Post 2002, water consumption has been reduced to an average of around 586,000 gallons per day. The primary reason for this decrease was due to modifications in plant operations. The plant now synchronizes electric production with demands. Thermo is a "peaking plant," which means it generates more electricity during peak periods such as morning and evening. The plant will reduce its electric generation during off-peak times. Water use at power plants has a direct relationship with electric generation. With the modification to operations at Thermo in 2002, the water use was greatly decreased.

Thermo is a combined cycle electric generation plant that utilizes a circulating water cooling tower for its main water/steam cooling source. Environmental emissions control for the five GE LM6000 combustion turbines is accomplished using steam injection into the combustion turbines to reduce NOX and CO emissions. The use of water/steam for these purposes is a common practice within the industry. The cooling tower uses water as the cooling medium and, as such, averages 312,000 gallons per day in water consumption due to evaporation losses. The steam injection emissions control system consumes an average of 274,000 gallons per day to control emissions from the five combustion turbines.

The design and operation of the plant mandates the use of the circulating water cooling tower and the steam injection emission control system to accomplish the plant's primary purpose – electric generation. Reducing water consumption below the levels achieved post 2002 would require the redesign of the circulating water cooling tower and/or the steam injection system.

It is possible to redesign these two plant water/steam systems and components, but it would be very expensive:

- The circulating water tower could be replaced with an air cooled tower at a cost of $15.9M. This is estimated to save 90% of current average of 312,000 gallons per day.
- The steam injection system on the combustion turbines could be converted to a dry low NOX injection system at a cost of $14M. This is estimated to save 80% of the current average of 274,000 gallons per day.

These cost estimates do not include the lost electric generation revenues that would be incurred during the lengthy conversion process, estimated at a year. The plant would not be able to produce electricity during this year with lost revenues of $50M-$60M. Costs of this magnitude could not be recovered within current market conditions, particularly at a time when more electricity, not less, is needed. As a result, it is unlikely that Thermo and the CGH will realize any significant water conservation measures beyond those already accomplished.

Thermo's water conservation options, estimated cost and water saved, are analyzed in Table 8.4.

Parks, Schools, Open Spaces, and Coyote Creek Golf Course

Historically, the City has done a good job of conserving the use of water for parks, schools and open spaces. The City recognizes that by being even more vigilant, it may be able to reduce its irrigation use throughout the City. As a result, the City is interested in pursuing opportunities that may be available to reduce its use of water on City parks and open spaces.

In a similar vein, the City is committed to managing the Coyote Creek Golf Course to further reduce water use in the most cost-effective manner possible, while still maintaining a first-class facility. Estimates and costs of water-savings programs for parks, schools, open space and the golf course can be found in Table 8.4.

Evaluation Criteria

Each of the conservation measures were ranked by *cost per gallon saved* for both potable (Table 8.3) and non-potable (Table 8.4). Similar criteria, as was used for the selection of conservation measures/programs to undergo further evaluation, were used for the selection of conservation measures/programs for implementation. The criteria utilized are as follows:

1. Benefit-cost of implementation
2. Public acceptance
3. Staff and Council approval

In addition to these criteria, the City also is aware that water conservation means different things to different customers, i.e. some are driven by financial savings, some for the good of the environment, some by regulatory programs, etc. Hence, the City wanted its list of conservation measures and programs to be as far-reaching as practical, thus reaching the largest pool of its citizens.

Selected Conservation Measures and Programs

Rebates and Incentives

- Rebates for rainfall and wind sensors
- Rebates for low-flow fixtures – toilets, showerheads and faucets

Educational Programs

- Water-savings demonstrations
- School programs
- Water facility tours
- Water bill informational inserts

Regulatory Controls

- Rate structure changes
- City-wide watering restrictions

Utility Maintenance Programs

- Place wind and rain sensors at parks, schools, open space areas, and golf course to avoid irrigation during high winds and/or rain
- Increase water treatment plant efficiency or find beneficial use for backwash water
- Replace turf with concrete at golf course
- Injecting wetting agent at golf course
- Leak identification and repair
- Irrigation equipment improvement at parks, schools, open space areas, and golf course
- Improve billing meters

Conservation Measures and Programs Not Selected

Of the list of potential conservation measures and programs to be implemented, three water conservation measures/programs were not selected. The two measures associated with Thermo and rebates for clothes washers. These were not selected due to the cost of implementation and low benefit-cost ratios.

Table 8.4 - Non-Potable Water Savings - Benefit/Cost Analysis

Conservation Measure		Total Cost to City			# of units	Total Annual Cost	Gallons Saved per Unit per Year	Estimated Water Saved per Year	Cost per Gallon Saved	Rank	Comments
		Rebate	Labor	Materials							
Thermo and CGH											
Replace Circulating Water Tower with Air-Cooled Tower		$0	$0	$0	1	$3,476,500	91,305,000	91,250,000	$0.0381	6	Air-Cooled Tower saves 250,000 gpd at a cost of $15.9 million. Plant would be shutdown for 1 year with associated lost revenue of $50M. (5% loan compounded for 20 years = 0.085). Assume $25 million in lost revenue for each improvement
Replace Steam Injection System with Dry Low Nox Injection System		$0	$0	$0	1	$3,315,000	90,209,340	90,155,000	$0.0368	5	Steam injection saves 247,000 gpd at a cost of $14 million.
Parks, Schools Open Space Areas and Golf Course											
Installation of rainfall/wind sensors		$0	$300	$200	2	$1,000	610,970	1,221,940	$0.0008	2	City irrigates approx. 180 acres (16 separate parcels) of Parks, Golf Course,etc. Each unit saves 2" of water per acre per year applied to 1/16th of total acreage.
Irrigation equipment improvement		$0	$2,500	$2,500	1	$5,000	10,200,000	10,200,000	$0.0005	1	City uses 204 MG per year irrigating Parks and Open Spaces. We estimate this value can be reduced by 5% by improving sprinkler operations
Injecting wetting agent		$0	$0	$1,000	180	$180,000	83,278	14,990,040	$0.0120	4	Wetting agents save 10% of annual irrigation amount of 460 ac-ft = 46 ac-ft
Replace turf with concrete		$0	$0	$0	1.85	$9,142	814,628	1,507,062	$0.0061	3	Golf Course can pave 1.85 acres, saving 2.5 ac-ft/acre. Concrete is 4" thick @$200/yard placed. Loan = 5% - compounded = 8.5%
						Total Estimated Cost		$195,142			
						Total Estimated Water Savings		28,114,184	gal		5% goal of 1,620 ac-ft = 26,393,931 gallons
						Total Estimated Cost per Gallon Saved		$0.0074			includes lost revenue at $0.50 per 1,000 gallons

Note: Green Programs are those the City will pursue immediately, yellow programs will be implemented over the long term and red programs will not be implemented

CHAPTER 9 – FORECAST MODIFICATION AND REEVALUATION

Demand Forecast Revision

The total future water demand (potable + non-potable) for the City through 2030 was revised to reflect benefits of the proposed water conservation. By implementing the selected conservation measures and programs, the revised total water demand is shown below.

Table 9.1 – Total Projected Future Water Demand with Water Conservation

Year	Total Water Usage (MG)	Total Water Usage (ac-ft)
2006	975	2,991
2007	999	3,065
2008	1,023	3,139
2009	1,047	3,213
2010	1,071	3,287
2011	1,095	3,361
2012	1,119	3,435
2013	1,143	3,509
2014	1,168	3,583
2015	1,192	3,657
2016	1,216	3,731
2017	1,242	3,811
2018	1,268	3,891
2019	1,294	3,971
2020	1,320	4,050
2021	1,346	4,130
2022	1,372	4,210
2023	1,398	4,290
2024	1,424	4,369
2025	1,450	4,449
2026	1,476	4,529
2027	1,502	4,609
2028	1,528	4,689
2029	1,554	4,768
2030	1,580	4,848

Project-Specific Savings

Future City of Fort Lupton projects fall into one of three broad categories: 1) development driven projects, 2) system improvements required due to future growth and 3) desirable system improvements.

The costs associated with development driven projects will be paid for by the developer. For example, if a developer requires additional infrastructure to service the development, then the developer will be required to pay for those improvements. Since these costs will be paid by the developer, they will not be discussed further.

Improvements required due to future growth are directly affected by this Water Conservation Plan. For example, when the City needs additional raw water supplies to accommodate future growth, the cost of those supplies is directly related to the amount of raw water required. The same is true for expansions of the City's WTP and WWTP. The benefits of water conservation can be seen directly in the demand side reduction identified in Table 9.1 above.

The third category of improvements relate to improving the reliability of the City's infrastructure. For example, we believe the City should consider the benefits of terminal raw water storage in the event of a failure in the CBT Southern Water Supply Pipeline from the Carter Lake Filter Plant. As with future growth, the cost of these supplies is directly related to the amount of raw water required. However, unlike future growth where development pays for infrastructure, the City will be the responsible entity for evaluating the recommended improvements, their cost-benefit ratios and ultimately constructing these improvements. Accordingly, no timeline can be established.

The most notable project-specific savings is related to expansion at the WTP. Based on current planning numbers, the WTP will need to be expanded in 2016. However, if the City realizes its water conservation goals, this expansion may be delayed another year or two, delaying a major capital investment.

Supply-Capacity Forecast Revision

The supply capacity forecasts previously identified will be reduced by the potable and non-potable goals identified by the City, respectively.

Potable Supply Goals

The City has established a goal of 5% reduction in water demand for the next 10 years and a 7% long-term reduction thereafter. Accordingly, we recommend a 95 ac-ft Mountain Water Storage Reservoir as opposed to the 100 ac-ft reservoir previously recommended.

Table 9.2 – 95 ac-ft Mountain Water Storage Reservoir with Water Conservation, Opinion of Probable Construction Costs

Item	Quantity	Unit	Unit Cost	Item Cost
Mob/Demob and general contract requirements	1	LS	$50,000	$50,000
Miscellaneous demolition and removal	1	LS	$50,000	$50,000
Land Acquisition	20	acres	$20,000	$400,000
Reservoir earthwork, lining, sitework	95	ac-ft	$3,000	$285,000
Telemetry system	1	LS	$50,000	$50,000
Transfer pumps and piping	1	LS	$200,000	$200,000
Subtotal				$1,035,000
Design and Construction Contingencies (20%)				$207,000
Contractors Overhead and Profit (15%)				$155,250
Construction Cost Subtotal				$1,397,250
Engineering - Design Phase Services (8%)				$111,780
Engineering - Construction Phase Services (4%)				$55,890
Total				**$1,564,920**

Treatment Plant Expansion

One of the City's goals is to increase the WTP efficiency. More specifically, the recommendation is for the City to increase the WTP efficiency within the next 10 years. This could result in a 5% overall reduction in the ultimate capacity required for the WTP. Unfortunately, treatment facilities are constructed in large units (typically 1 MGD units), so the City will most likely construct a WTP consisting of 7 x 1 MGD micro-filters as opposed to, say, 6.65 x1 MGD filters. Accordingly, we have no recommended changes to the costs of the next WTP expansion.

Table 9.3 – WTP Expansion with Water Conservation, Opinion of Probable Construction Costs

Item	Quantity	Unit	Unit Cost	Item Cost
Mob/Demob and general contract requirements	1	LS	$50,000	$50,000
Earthwork, grading and misc. sitework	1	LS	$100,000	$100,000
Valve and piping modifications (existing filters)	1	LS	$50,000	$50,000
Process piping and valves for new filters	1	LS	$200,000	$200,000
90M10C units	2	LS	$300,000	$600,000
Electrical, controls and instrumentation	1	LS	$150,000	$150,000
Plant SCADA / PLC control system upgrades	1	LS	$40,000	$40,000
Telemetry system improvements	1	LS	$15,000	$15,000
Backwash recovery system	1	LS	$750,000	$750,000
Subtotal				$1,955,000
Design and Construction Contingencies (20%)				$391,000
Contractors Overhead and Profit (15%)				$293,250
Construction Cost Subtotal				$2,639,250
Engineering - Design Phase Services (8%)				$211,140
Engineering - Construction Phase Services (4%)				$105,570
Total				**$2,955,960**

Finished Water Storage and Distribution

The City has adequate water storage facilities to last until the next expansion of the WTP, assuming all of the growth occurs within existing pressure zones. Unfortunately, the City may not have complete control over when these facilities will be required. Accordingly, we have not recommended any changes to the recommended transmission, distribution and storage improvements.

Water Rights Purchase

Based on the City's goal to reduce potable and non-potable demands by 5% over the next ten years, the City should be able to reduce its water rights portfolio accordingly. However, it is very difficult to quantify the reduction in water rights purchases due to water conservation due to the complicated intricacies of the City's system and how it manages its water. For the purposes of this analysis, a 5% reduction in water acquisition is used.

Table 9.4 – Water Rights Purchase Costs with Water Conservation

Water Right	Number of Shares Needed	Consumptive Use Per Share (ac-ft)	Unit Cost ($/ac-ft CU)	Total Cost ($)
Fulton Ditch	105	1.75	$10,000	$1,837,500
Windy Gap	4	100	$18,000	$7,200,000
Total				**$9,037,500**

Augmentation Storage

Previously, the City estimated a need for 200 ac-ft of Fulton Ditch storage. The City has negotiated 100 ac-ft for Fulton Ditch storage with a developer. The City has an option on another 100 ac-ft, but will have to pay for it. Based on the water conservation goals established by the City, the City can reduce its Fulton Ditch storage requirement by 5 ac-ft. The revised estimated costs of this storage are shown in the following table.

Table 9.5 – Fulton Ditch Storage w/ Water Conservation, Opinion of Probable Construction Costs

Item	Quantity	Unit	Unit Cost	Item Cost
Mob/Demob and general contract requirements	1	LS	$50,000	$50,000
Earthwork, grading and misc. sitework	1	LS	$50,000	$50,000
Raw Water Storage	95	ac-ft	$2,500	$237,500
Subtotal				$337,500
Design and Construction Contingencies (20%)				$67,500
Contractors Overhead and Profit (15%)				$50,625
Construction Cost Subtotal				$455,625
Engineering - Design Phase Services (8%)				$36,450
Engineering - Construction Phase Services (4%)				$18,225
Total				**$510,300**

The City will also need 500 ac-ft of additional Windy Gap Effluent storage. The City is in negotiations to obtain 100 ac-ft through a developer. If the City is successful, the City will need to purchase an additional 400 ac-ft. Water conservation will reduce this storage need by 5%.

Table 9.6 – Windy Gap Effluent Storage with Water Conservation, Opinion of Probable Construction Costs

Item	Quantity	Unit	Unit Cost	Item Cost
Mob/Demob and general contract requirements	1	LS	$100,000	$100,000
Earthwork, grading and misc. sitework	1	LS	$50,000	$50,000
Raw Water Storage	380	ac-ft	$3,500	$1,330,000
Subtotal				$1,480,000
Design and Construction Contingencies (20%)				$296,000
Contractors Overhead and Profit (15%)				$222,000
Construction Cost Subtotal				$1,998,000
Engineering - Design Phase Services (8%)				$159,840
Engineering - Construction Phase Services (4%)				$79,920
Total				**$2,237,760**

Forecast Modifications and Benefits of Conservation

The positive effects of implementing a Water Conservation Plan are evident both in the supply side and on the demand side. This is particularly evident on the demand side. With implementation of the 7% long-term reduction goals, the City can stretch its existing supplies, thus delaying costly capital improvements. In turn, on the supply side, these future facilities can be reduced in size directly in proportion to the reductions on the demand side.

Revenue Effects

Intuitively, the implementation of water conservation measures should reduce the cash flow to the City. This is true assuming the City charges for all the water delivered to its customers. However, one of the most revealing elements of this study is the apparent shortfall between what the City is measuring out of the WTP and the individual service meters. This discrepancy is in favor of the users, (i.e. unregistered flows) not the City.

As a result, one of the recommendations of this study is to determine the financial impacts to the City from this unaccounted-for water. We believe this number may be significant and would offset the loss in revenues. However, until further analysis of these apparent discrepancies is completed, it would be premature to evaluate any other changes to the existing rate structures or other effects on revenue.

CHAPTER 10 – IMPLEMENTATION PLAN

Implementation Schedule

Table 10.1 – Potable Water Conservation Implementation Schedule

	Action Required for Implementation	Potential Factors that could cause delay	Anticipated Implementation Date
Rebates & Incentives			
Rebates for residential moisture/wind sensors	Council Approval by 6/1/07	Inability to obtain implementation grant money or otherwise fund measure	10/1/2007
Rebate for low-flow toilet	Council Approval by 6/1/07	Inability to obtain implementation grant money or otherwise fund measure	10/1/2007
Rebate for low-flow showerhead	Council Approval by 6/1/07	Inability to obtain implementation grant money or otherwise fund measure	10/1/2007
Rebate for low-flow faucets	Council Approval by 6/1/07	Inability to obtain implementation grant money or otherwise fund measure	10/1/2007
Educational programs			
Water-savings demonstrations including school programs	Council Approval by 6/1/07	Unavailability of staff time	10/1/2007
Water facility tours (2/year)	Existing City Program, no further action required	Unavailability of staff time	Existing
Water bill inserts	Existing City Program, no further action required		Existing
Regulatory Controls			
City-wide watering restrictions	Existing City Program, no further action required		Existing
Rate structure changes	Existing City Program, no further action required		Existing
Utility Maintenance Programs			
Increase WTP efficiency	Council Approval by 12/1/2016	Improvements should be done simultaneous with next WTP expansion	4/1/2017
Leak identification and repair	Council Approval by 3/1/08, obtain grant money	Inability to obtain implementation grant money or otherwise fund measure	6/1/2008
Improve billing meters	Council Approval by 6/1/07, obtain grant money	Inability to obtain implementation grant money or otherwise fund measure	10/1/2007

Table 10.2 – Non-Potable Water Conservation Implementation Schedule

	Action Required for Implementation	Potential Factors that could cause delay	Anticipated Implementation Date
Parks, Schools, Open Space, and Golf Course			
Installation of rainfall/wind sensors	Council Approval by 6/1/07, obtain grant money	Inability to obtain implementation grant money or otherwise fund measure	10/1/2007
Irrigation equipment improvement	Council Approval by 6/1/08, obtain grant money	Inability to obtain implementation grant money or otherwise fund measure	10/1/2008
Injecting wetting agent	Council Approval by 6/1/07, obtain grant money	Inability to obtain implementation grant money or otherwise fund measure	10/1/2007
Replace turf with concrete or native grass	Council Approval by 1/1/08, obtain grant money	Inability to obtain implementation grant money or otherwise fund measure	4/1/2008

Plan for Public Participation in Implementation

The City of Fort Lupton is committed to public participation in its on-going commitment to water conservation. Accordingly, the City will commit to the following:

Within the City's billing notices each spring, the City will announce the elements of that respective year's water conservation plan and provide a feedback loop within the City's website for residents to provide input into proposed conservation measures, suggest improvements, modifications, etc. Following that feedback period, the City will update its water conservation schedule, notify its constituents of measures to be implemented for that year, and communicate progress toward its goal.

Plan for Monitoring and Evaluating Processes

The water savings associated with the implementation of measures outlined in the Water Conservation Plan, as approved by the City, will be evaluated on an annual basis. The water usage will be measured and compared to projected water usage estimates to quantify water savings. Costs and revenue loss will also be quantified. The City will measure the effectiveness of each of the major subcategories defined within the implementation schedule for both the potable and non-potable utilities annually. Any ineffective programs will be evaluated with a focus on improvement prior to being removed from the plan.

Plan for Updating and Revising the Conservation Plan

The City will evaluate the effectiveness of its conservation measures/programs annually and will update the Water Conservation Plan at a minimum of every five years.

APPENDIX A

Public-Review Process

The City of Fort Lupton has completed a draft water conservation plan. The goal of the plan is for the City to develop strategies and programs for efficient and sustainable water use. The only conservation measure the City has implemented since 2003 is:

- No outside watering from 10 am to 6 pm every day beginning May 1st and ending August 31st.
- Exclusions and exceptions include:
- Coyote Creek Golf Course greens and tee boxes.
- Waivers for new lawns, except for the period June 1st through August 31st.
- Residential car washing provided that a bucket and a hand-held hose with a shut-off nozzle is used.
- Commercial car washes.

Before finalizing the water conservation plan, the City welcomes input from its residents. The City shall have a 60-day public review period beginning the date this notice is published. A complete draft copy will be kept at City Hall located at 130 S. McKinley Avenue for you to review. The City will also post the plan on its website at www.fortlupton.org.

All written comments are due to Barb Rodgers, City Clerk, 130 S. McKinley Avenue, prior to March 10, 2007.

First Publication January 10, 2007
Name of Publication Fort Lupton Press

PROOF OF PUBLICATION
FORT LUPTON
STATE OF COLORADO
COUNTY OF WELD SS.

I, Karen Lambert, do solemnly swear that I am the Publisher of the Fort Lupton Press; that the same is a weekly newspaper printed and published in the County of Weld, State of Colorado, and has a general circulation therein; that said newspaper has been published continuously and uninterruptedly in said county of Weld for a period of more than fifty-two consecutive weeks prior to the first publication of the annexed legal notice or advertisement; that said newspaper has been admitted to the United States mails as second-class matter under the provisions of the act of March 3, 1879, or any amendments thereof, and that said newspaper is a weekly newspaper duly qualified for publishing legal notices and advertisements within the meaning of the laws of the State of Colorado. That the annexed legal notice or advertisement was published in the regular and entire issue of every number of said weekly newspaper for the period of 1 consecutive insertion(s); and that the first publication of said notice w as in the issue of newspaper, dated 10th day of January, 2007, and the last on the 10th day of January, 2007.

Publisher. Subscribed and sworn before me, this the 5th day of January, 2007.

Notary Public.

BOBI LOPEZ
NOTARY PUBLIC
STATE OF COLORADO
MY COMMISSION EXPIRES 11/24/2010

CASE NO. 401951 key 36748

APPENDIX B

City Council Adoption

CITY OF FORT LUPTON
CITY COUNCIL

Performance, Integrity, Teamwork, Accountability and Service

UAM 2007-010

APPROVE RESOLUTION 2007-023 REAPPROVING THE CITY OF FORT LUPTON WATER CONSERVATION PLAN FOR SUBMISSION TO THE COLORADO WATER CONSERVATION BOARD (CWCB)

I. **Agenda Date:** Council Workshop – March 21, 2007
Council Meeting – March 28, 2007

II. **Attachments:**
A. Water Conservation Plan
B. Resolution 2007-023

III. **Summary Statement:**

The City received a grant from the CWCB to update the water conservation plan and contracted with Clear Water Solutions to prepare the plan. The plan has been completed, reviewed by Council and was approved on November 20, 2006. However, a sufficient opportunity for public input had not been provided. That 60-day opportunity expired on March 10, 2007 and now the plan is ready for submission to the CWCB for their approval. The approved plan will make the City eligible for grants to implement various parts of the plan over time.

IV. **Fiscal Note:** None

Finance Department Use Only

Finance Director

V. **Submitted by:** City Administrator

VI. **Approved for Presentation:** City Administrator

VII. **Certification of Council Approval:** City Clerk — Date 03/28/2007

VIII. Detail of Issue/Request:

The City received a grant from the CWCB to update the water conservation plan and contracted with Clear Water Solutions to prepare the plan. The plan has been completed, reviewed by Council and was approved on November 20, 2006. However, a sufficient opportunity for public input had not been provided. That 60-day public comment period expired on March 10, 2007 and now the plan is ready for submission to the CWCB for their approval. The approved plan will make the City eligible for grants to implement various parts of the plan over time

Approval of this resolution will allow for the plan submission to CWCB and be an indication of the Council's endorsement of the plan.

IX. Legal/Political Considerations:

None.

X. Alternatives/Options:

1. *Approve the Resolution*
2. *Not approve the Resolution*

XI. Financial Considerations:

None

XII. Staff Recommendation:

Approve UAM 2007-010 approving Resolution 2007-023 reapproving the Water Conservation Plan for submission to the CWCB.

RESOLUTION NO. 2007-023

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF FORT LUPTON APPROVING THE CITY OF FORT LUPTON WATER CONSERVATION PLAN, AND ITS SUBMISSION TO THE COLORADO WATER CONSERVATION BOARD (CWCB).

WHEREAS, the City of Fort Lupton has received a grant from the CWCB to update the Water Conservation Plan, and

WHEREAS, the Clear Water Solution has prepared such a plan at the City's request and the plan is now complete and ready for submission to the CWCB for their approval.

NOW THEREFORE BE IT RESOLVED that the City of Fort Lupton hereby approves the revised City of Fort Lupton Water Conservation Plan and its submission to the CWCB.

APPROVED BY THE FORT LUPTON CITY COUNCIL THIS 28th DAY OF MARCH 2007.

City of Fort Lupton, Colorado

Shannon Crespin

Shannon Crespin, Mayor

Approved as to form:

T. William Wallace

T. William Wallace, City Attorney

Attest:

Barbara Rodgers

Barbara Rodgers, City Clerk

UAM 2007-010

APPENDIX C

Public Comments and Response

No comments were received on Fort Lupton's 2007 Water Conservation Plan.