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WATER RESOURCES MASTER PLAN

For the Town of Buena Vista – *August 2006*

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This document was developed for the use of the Town in its planning process. It is intended to be a working document that is used as a guideline for planning decisions and will need to be periodically updated to reflect actual conditions.

Portions of this report are subject to State and Federal restrictions related to Homeland Security.

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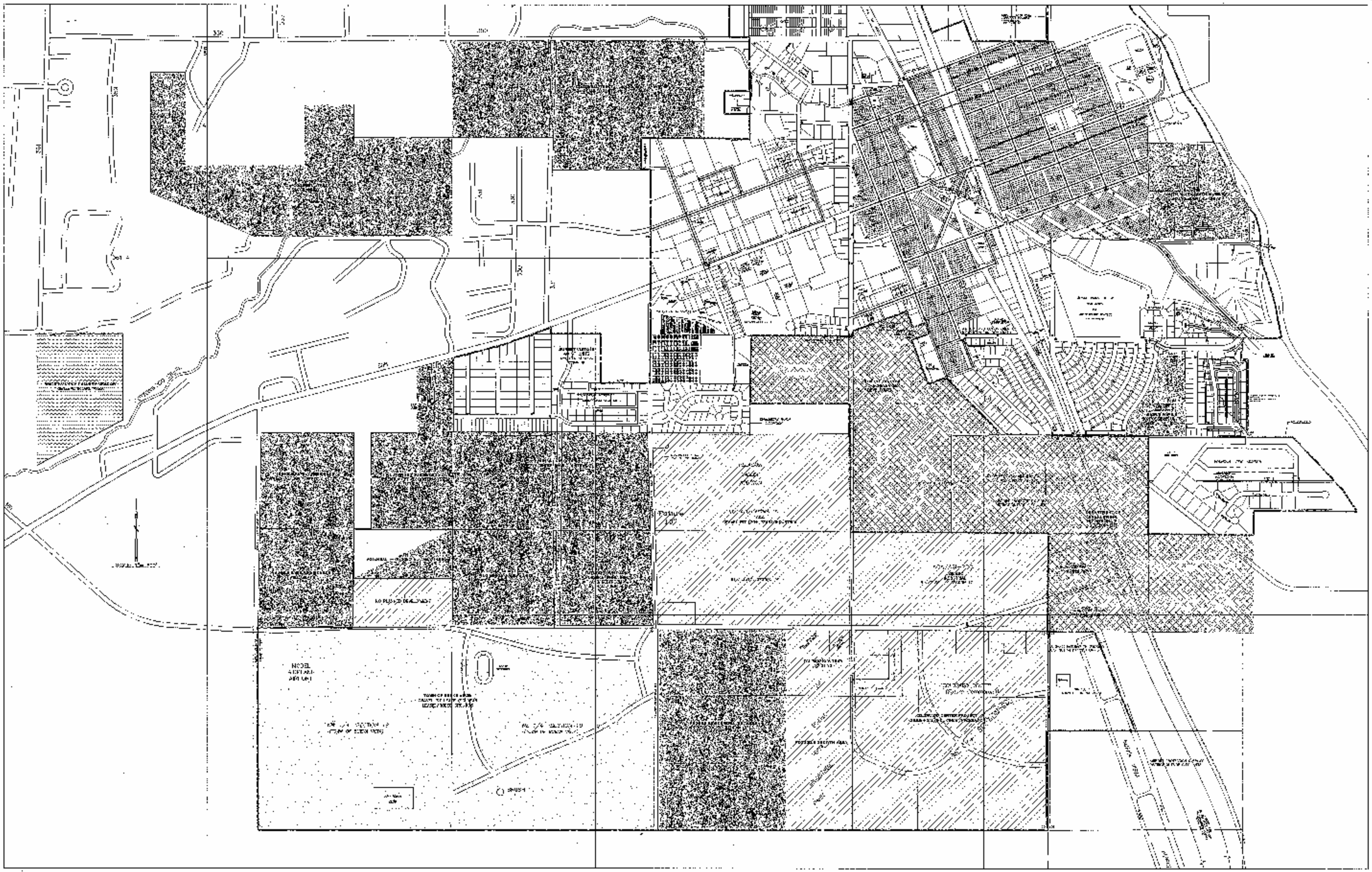
Demographics

- Buena Vista has experienced quite varied annual growth rates over last couple decades, from 1.8% in the early 90's to 6.1% in the late 90's to 3.8% over the last 5 years.
- The Town currently appears to be in a steadier, more consistent pattern that will likely continue for some time.
- Analyses suggest using 3.5% annual growth rate for planning purposes.
- The Lower Zone will add approximately 663 EQR at buildout.
- The Upper Zone will add approximately 1470 EQR at buildout.



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WATER SYSTEM MASTER PLAN

Buena Vista, Colorado

Demographics Planning Map

Job No.	2002-254.003
Drawn by	CAP
Date	6/05/06

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Estimated Future Upper Zone Development

Cogswell Tract	670 Units	600 EQR
Southard (South)	300 Units	285 EQR
Sunset Vista III	50 Units	48 EQR
Sunset Vista IV*	274 Units	260 EQR
Meadow Ridge II	16 Units	15 EQR
Unnamed Upper Zone	225 Units	214 EQR
Other Infill	50 Units	48 EQR
Total	**1585 Units**	**1470 EQR**

*Portions of these developments are already approved.

Note: Residential EQR projections assume average 4:1 ratio of single family to townhome = 0.95 EQR on average. Cogswell Tract estimate is based on mixed use description contained in letter

from developer dated 4/21/06.

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Estimated Future Lower Zone Development

Crossman	94 Units	89 EQR
South Main Addition*	400 Units	380 EQR
College Heights Area	50 Units	48 EQR
Other Infill	75 Units	71 EQR
Industrial Park	50 Units	50 EQR
Other Commercial	25 Units	25 EQR
Total	**694 Units**	**663 EQR**

*Portions of these developments are already approved.

Note: Residential EQR projections assume average 4:1 ratio of single family to townhome = 0.95 EQR on average. Cogswell Tract estimate is based on mixed use description contained in letter

from developer dated 4/21/06.

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Demands

- Production and billing records for the last 8 years were reviewed. However, only the last 5 years were used for calculating average use values. This is because water meters were installed in 1998 and it took a few years for customers to adjust.
- Average use per tap has declined rapidly after the installation of the meters, and has leveled off to more “typical” values (and is still declining).
- Last 5 years are good years to use for estimating as they coincide with historic drought period.
- Unaccountable losses have been quite high. However, Staff has recently believes the culprit is the line to the DOC. Staff has isolated this line and will need to compare billing and production records to verify.
- The Town must remain vigilant to minimize Unaccounted losses because it affects revenues, water rights and operating costs.

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Demands

- Current max. day demands of 1.4 MGD (=2.17 CFS).
- Currently average 2.1 persons per tap.
- Currently use average of 400 GPD per tap (=planning value).
- Peaking Factor = 2.62 for Max Day / Average Day.

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Historical System Demands

Demand Condition	Year					
	2001	2002	2003	2004	2005	Average
# of Taps	1,186	1,255	1,331	1,375	1,425	1,314
Average Day Demand	0.508	0.553	0.541	0.516	0.533	0.530
Maximum Day Demand	1.61	1.28	1.36	1.18	1.52	1.39
ADD per Tap	428	441	406	375	374	403
MDD per Tap	1,359	1,019	1,021	855	1,061	1,058
Average MDD to ADD Peaking Factor 2.62						

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Water Treatment & Production

- Several key unknowns prevent establishment of a firm capital improvements program for production and treatment infrastructure.
  - Source water sampling at the water plant for E. Coli/ Cryptosporidium to determine the impact of the Long-term Surface Water Treatment Rule.
  - Well feasibility study - Arkansas and Cottonwood Creek basins.
- Current max production requirement of about 1.4 MGD. Currently meet using just the Infiltration Gallery and Well #2.
- Current firm (= reliable) capacity of about 2.1 MGD (w/recharge + WTP + well) – barring any WQ regulation issues.
- The Town could face $5M (or more) in capital costs to upgrade and expand its production/treatment facilities over the next 15 years to meet growing water demands and future water quality standards. This will significantly impact both tap fees and water use rates.

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Water Treatment & Production

- Before the Town's WTP is returned to service, the Town should install the instrumentation and recording devices at two booster pump stations to track chlorine levels for regulatory compliance.
- The Town should rectify unaccounted water discrepancies this year and begin collecting data in which it has confidence. This will allow verification of water demand assumptions that serve as a basis of this plan.
- There are a handful of recommended near-term upgrades to the treatment plant site to improve reliability, operations, and environmental conditions that this plan identifies. Most should be implemented as soon as possible.

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Water Rights

- Currently the Town has a reliable 10 CFS for the months of November-March
- The Town only has 3.88 CFS (2.51 MGD). available during the irrigation season (April-October).
- Historically these rights have been reliable. In the dry years of 1977 and 2002 the Town was able to take all of the water that it needed.
- However, increasing demand on the Arkansas River could lead to water shortages in the future.
- For this reason it is strongly recommended that the Town actively pursue additional water rights immediately.

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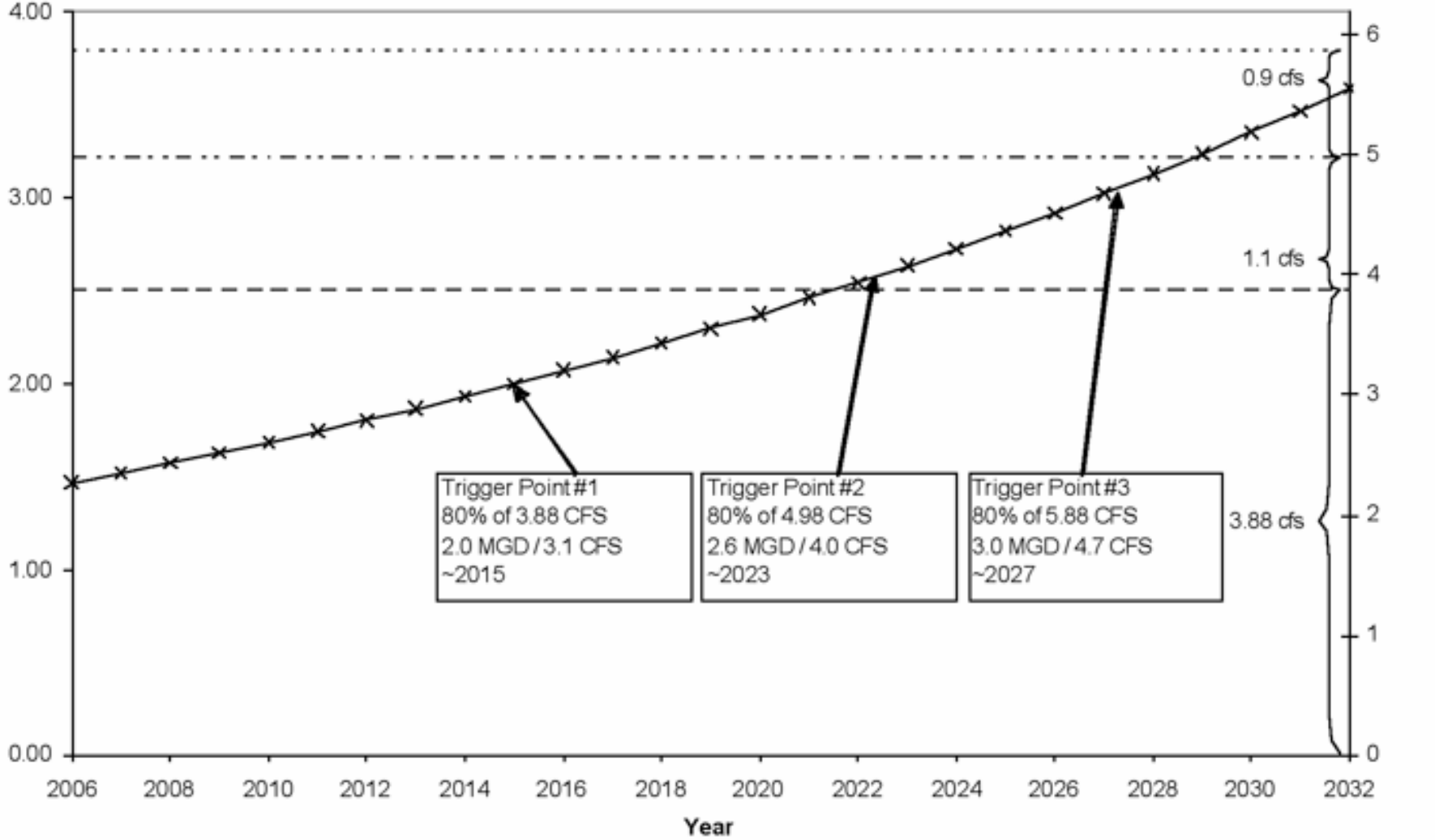
Water Rights

- Three Trigger Pints were established to provide the Town with a timeframe for obtaining additional water.
- These Trigger Points should be considered as “Last Minute” deadlines.
- Given the current state of water resources within the Arkansas River Basin it is strongly encouraged that the Town act on these prior to the Trigger Points.
- The actual timing of these Trigger Points will depend on actual demand and may occur sooner or later than indicated.
  - T. P. #1 (approx. yr.-2015): When MDD is 3.1 CFS (80% of 3.88 CFS)
  - T.P. #2 (approx. yr.-2022): When MDD is 4.0 CFS (80% of 4.98 CFS)
  - T.P. #3 (approx. yr.-2027): When MDD is 4.7 CFS (80% of 5.88 CFS)

Buena Vista Water Rights vs. Projected Maximum Day Demand



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Water Rights

- As these Trigger Points are reached the Town will be required to make more water available for diversion at the Town's intake structures. The possible sources of additional water are outlined below.
  - Existing Water Rights-The Town should diligently work towards putting all of their existing water rights into production.
  - Additional Water Rights-The Town should acquire additional senior irrigation water rights on either Cottonwood Creek or the Arkansas River. Due to the increasing demand for Arkansas River water the Town should pursue these rights as soon as possible.

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Water Rights

- New Wells- While the installation of a new well does not, in and of itself, increase the Town's legal supply of water, there may be operational advantages to installing additional wells. If a new well is combined with senior water rights these advantages are magnified. A well that is tributary to the Arkansas River has advantages over a well which is tributary to Cottonwood Creek. Out of priority well diversions on the Arkansas are more easily augmented than on Cottonwood Creek because of the availability of contracted water (Fry-Ark) on the Arkansas River. Additionally, a well in the Arkansas River Alluvium would provide a second source of water in addition to Cottonwood Creek. The construction of a well which is tributary to Cottonwood Creek would not offer the advantages that an Arkansas well would. However, there may be operational advantages to constructing more wells which are tributary to Cottonwood Creek due to the reduced treatment requirements of groundwater.

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Water Rights

- Augmentation Storage- The ability to store water allows a water right to be stored while it is in priority and released at a later time to satisfy demand when it is out of priority. The water can be released and diverted or it can be released to satisfy downstream users (e.g. exchange or augmentation). The Town has, and should continue to, pursue all available storage options, preferably within the Cottonwood Creek basin. The development of a new storage facility will potentially require a significant investment of time and money and for this reason may not be feasible unless done in conjunction with an Intergovernmental Agreement – e.g. Fox Lake and above Cottonwood Lake on Cottonwood Creek.

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Distribution System

- A water model of the Town water system has been developed and calibrated using fire hydrant flow tests. The calibrated model is a good planning tool.
- The water model does not indicate any significant concerns (i.e. pressure, fire flow, pipe velocity, etc.) in the existing distribution system.
- Future conditions analyses indicate that the existing system can be adapted for future demands. The required modifications will be additional system looping (at the expense of the developer).
- No upgrades to existing pipes appear necessary to maintain current service conditions. However, this master plan recommends upgrading the 4” and 6” lines on the east side of HWY 24, from Brookdale to Farwell, to 8” pipe to increase fire flow allow system expansion to the north along the highway.

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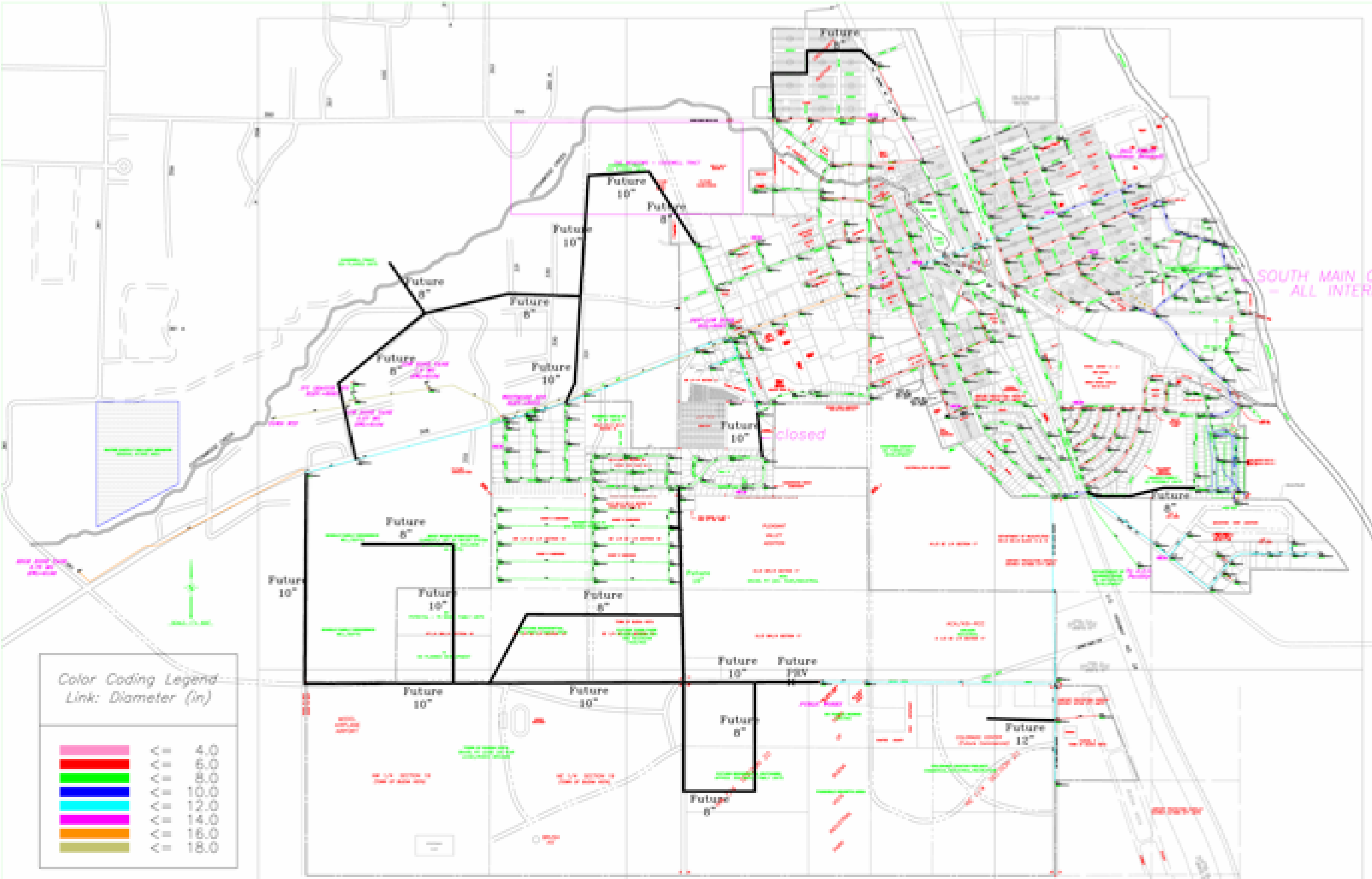
Distribution System

- A The Town should start building a “pipe replacement fund” to replace aging infrastructure (there are some pipes in the system that are over 50 years old).
- The Town should standardize their system with minimum 8” pipe. This means that all 4” and 6” pipe should be upsized to 8” when they are replaced, and all new developments should only use 8” or greater.
- Preliminary investigations indicate that it is feasible to convert the Ivy League subdivision to gravity service off the Upper Zone tank. The town will need to perform a more detailed analysis during preliminary engineering to confirm service conditions given the chosen routing and flows requirements.
- The majority of the Future Improvements herein recommended should be funded by development.



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WATER SYSTEM MASTER PLAN

Buena Vista, Colorado

FUTURE SYSTEM LAYOUT

Drawn by: CAP

Date: 8/06/06

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Storage

- Tank storage volumes are based on three components: equalization volume, fire storage volume and emergency storage.
- Equalization storage for the Town of Buena Vista is herein established as 70% of the ADD.
- Fire storage is equal to the highest fire flow requirement in each zone. In the Lower Zone, fire storage is equal to 3500 GPM for 3 hours, or 630,000 gallons. In the Upper Zone, fire storage is equal to 1500 GPM for 2 hours, or 180,000 gallons.
- Emergency storage for rare events such as power outages and plant repairs has been set at 75% of the ADD, which is sufficient for normal conditions for 18 hours.
- Both the Lower Zone and the Upper Zone have sufficient storage for *current* conditions.

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Existing Zone Storage Analysis

ZONE STORAGE REQUIREMENTS	Full Tank HGL	Current Storage	Fire Volume	Current EQR	Current Total Storage Req'd	Available EQR
Lower Zone	8,104	1.77MG	0.63MG	1,621	1.57MG	**345**
Upper Zone	8,198	0.75MG	0.18MG	310	0.36MG	**673**

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Future Zone Storage Analysis

ZONE STORAGE REQUIREMENTS	Buildout EQR	Domestic	Fire	Emerg.	Total
Lower Zone	1,815	0.51MG	0.63MG	0.54MG	**1.68MG**
Upper Zone	1,679	0.47MG	0.18MG	0.50MG	**1.15MG**

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Storage

- The Lower Zone has sufficient storage to serve 814 EQR beyond its current service. This equates to 115 EQR beyond buildout estimates.

- The Upper Zone can support an additional 673 EQR. However, under buildout conditions, the Upper Zone will need another 500,000 gallons of storage.

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Secondary Water Supply

- Non-potable water use (i.e. irrigation) typically accounts for 50% of the summer water demand. This significantly increases infrastructure costs, treatment costs and long-term operation costs.
- The Town should investigate conversion of the Town ball fields and parks to dedicated non-potable well systems.
- The Town should push for new developments to install, operate, and maintain their own non-potable irrigation water systems wherever this is feasible. This should be a top priority for the City in any annexation processes.

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Watershed Protection

- The Town should adopt defined protection zones that specify acceptable sewerage systems in effort to standardize and facilitate the permit review process. The protection zones should be based on proximity and potential affect to Town water supply sources.
- Set clear requirements on what must be submitted to apply for a permit from the Town, depending on the specific management zone where a use is proposed.
- Require regular maintenance inspections of ISDS systems within critical protection zones that are filed with the Town.
- The Town should foster the development of a Watershed Stakeholders Group.
- The Watershed Protection Plan should be expanded to include proactive water quality and quantity monitoring.

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Water System Rules, Regulations & Fees

- The Town should adopt a more defined EQR apportioning schedule to more accurately assess system impacts and fee assessments.
- The Town should raise their water service fees now to account for known future expenditures.
- The Town should conduct tap fee and service rate studies.
- The Town should annually review water rights cash-in-lieu fees to ensure that fees are sufficient for current market conditions.

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Capital Improvement Plan

- *Well Source Investigation* – this study should be started as soon as possible. The first phase to be conducted in 2007 should include evaluation of existing local wells data, water quality analysis and testing of the local shallow aquifers, and establishing potential well locations. The second phase to be conducted in 2008 should include drilling new wells and testing productivity. In some instances, even if the water is not suitable for potable purposes, it may be possible to use the groundwater for non-potable irrigation purposes.

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Capital Improvement Plan

- *Pipe Replacement Program* – Because the Town's distribution system has cast iron pipe that is 50+ years old, the Town needs to begin planning for the inevitable replacement of these pipes that are nearing the end of their design life. We subsequently recommend starting a capital reserve fund for annual pipe replacement to begin in about 5 years. The Town should plan on replacing 1000 feet per year, beginning with known and suspect bad pipes and then systematically moving to oldest remaining pipes. The exception to this systematic pipe replacement program are 4" and 6" lines on the east side of HWY 24, from Brookdale to Farwell, to increase fire protection and allow service expansion farther north along the highway, which is recommended in the next few years. For the purposes of budgeting, $100/lf is herein used.

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Capital Improvement Plan

- *Ivy League conversion* –improvements required for conversion of the Ivy League subdivision to gravity service from the Upper Zone gravity system will require engineering to confirm service conditions given the selected routing and flow requirements (and fire flow). To this point it has been assumed that the existing system is adequately sized, in good operating condition, and that only connection to the Upper Zone is required (i.e. not replacing piping within the subdivision).

Table 11.1.1 – Recommended Capital Improvements by Year

Item	Note	Approx. Timing	Estimated Capital Cost ($M)
Well investigations - plant site, upper pressure zone, and Arkansas alluvium	Evaluate potential sites, water rights considerations, water quality, and well yield, including paper studies, water quality sampling/analysis, test well construction, and pump tests.	2006-8	$0.100M[1,5]
Cottonwood Creek *E. Coli/Crypto.* sampling	Perform as soon as possible to determine LT2 Rule impact	2007-8	$ 0.010M
On-line chlorine analyzers at Ivy League and Westmoor BPSs	Cl_2 and pH analyzers, plumbing, and data recording devices, SCADA at Ivy League PS	By 2007	$ 0.030M
New flow meters and piping at WTP site for finished water	Assuming three flow meters to be replaced	By 2007	$ 0.050M[2]
Replace 4" and 6" lines from Brookdale to Farwell along Hwy 24.	Improve fire flows and allow service expansion to North along highway (approx. 1600 lf)	2007/8	$ 0.160M

Table 11.1.1 – Recommended Capital Improvements by Year

Pipe replacement program	Annually replace approx. 1000 lf of aged distribution system pipe	2012-on	$0.100M/yr
New well for ball fields	50-GPM capacity with piping, electrical, controls, etc.	By 2013	$ 0.075M[2]
Dedicated on-site chlorine contactor for WTP flows (baffled 160-kgal basin)	To provide 0.5-log *Giardia* inactivation with 1-mg/L free chlorine and 3-MGD of flow from WTP	By 2020[3]	$ 0.550M
Dedicated on-site chlorine contactor for Well #2 and infiltration gallery flows (baffled 8-kgal basin)	To provide 4-log virus inactivation with 1-mg/L free chlorine and 450 GPM of combined flow from Well #2 and infiltration gallery	By 2020[3]	$ 0.110M