REPORT

SOURCE WATER MASTER PLAN

Volume 1 - Summary Plan

FINAL | APRIL 2009

in association with

MWH amec

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WHAT IS THE SOURCE WATER MASTER PLAN?

The Source Water Master Plan (SWMP) is intended to be a foundation document that will allow informed decision-making regarding one of the city's most important assets, its water supplies. Boulder's founders recognized the importance of a reliable water supply and began developing a water supply system for the growing city in the late 1800's. Careful planning for the city's future water needs now can help assure that future Boulder citizens also inherit a reliable and sufficient water supply. The SWMP documents the current status of the city's water resources and raw water facilities and defines issues to be addressed to provide for the city's future water supply needs. The SWMP and its recommended projects and programs provide a framework for sustainable management of the city's source waters so that future water supply needs are met through drought periods without violating adopted reliability criteria.

QUESTIONS RAISED IN THE SWMP

One of the key outcomes of the CSG process was the framing of four distinct questions to be addressed either directly in the SWMP or in its recommended studies. Following are the four questions:

1. **Does Boulder have enough water for its municipal system?**

   What factors might alter the current projection that Boulder has sufficient water to meet build-out needs? What level of reliability is acceptable at build-out? How are population and employment factors be accounted for in projecting adequacy of water supply? How might climate change affect Boulder's water supply and the quality of life it supports? What sources should be pursued if additional water is required? Is it strategic to buy new supplies now before knowing if events may require it, or should we focus on other priorities?

2. **How should Boulder use its municipal water supplies?**

   Once municipal water needs are met, how should water be divided up between other uses (e.g., preserving natural resources/instream flows, supporting local agriculture, landscaping, groundwater recharge, etc.)? How does climate change affect these decisions?

3. **What should Boulder do to protect the watersheds supplying its water?**

   What watershed management and wildland fire protection measures are necessary to protect the city's water supply? How do we deal with water quality impacts such as those associated with Nederland's wastewater treatment system? What measures are required to sustain the supply treated at the Boulder Reservoir WTF?

4. **How should Boulder prioritize water system expenditures and improvements?**

   Are the benefits of the Carter Lake Pipeline enough to make it a priority compared to other projects? What improvements are needed to maintain the Barker System facilities? How do we maintain reliability of the watershed dams? Should storage enhancement opportunities be pursued?

The SWMP Community Study Group (CSG), a key component of the SWMP public process, identified four important questions (see inset on the previous page). While all four questions are central to the SWMP, the first one is fundamental to the city's water supply planning and asks, "Does Boulder have enough water for its municipal system?" Past and current studies predict that as long as current supply and drought management strategies remain in place, the city will have enough water in the future, even with climate change and predicted population increases. While staff intends to keep a close eye on future climate change science and water supply modeling, the focus of the SWMP is not, "Where does the city find more water?" The focus is rather on the future steps and considerations needed to manage the existing source water system, including its aging infrastructure. To that end, the scope of the SWMP includes several different efforts, such as:

- Defining emerging issues that affect how the city will manage and operate its source water system in the future.
- Recommending future studies and actions that should be undertaken.
- Providing general budgeting information and project prioritization to guide development of the twenty-year Capital Improvements Program (CIP) so that source water deliveries are dependable.
- Compiling existing information about the city's source water system including background information, a review of the city's raw water system assets, current operation and maintenance practices, agreements, and other legal constraints on the city's raw water operations. Documenting current policies for management of the city's source water.
- Reviewing water use levels and water rights yields to assist in periodic re-evaluation of future demands.
- Recognizing and being consistent with the goals, policies and growth projections of Boulder Valley Comprehensive Plan, and being consistent with other city master and strategic plans.

The SWMP contains two volumes. The first volume contained herein provides a summary level of detail aimed at a general audience. Volume 1 is consistent with other city master plans and planning documents in terms of format, content and level of detail. The second volume contains much more detail on background, system management, issues and recommendations. Volume 2 provides the details necessary for future execution of programs and projects. Volume 2 also documents critical system information in one place in a way that has never been done before, which will be valuable to current and future staff. The second volume is prepared more for an audience having or desiring detailed institutional knowledge of the source water system.

Section 1

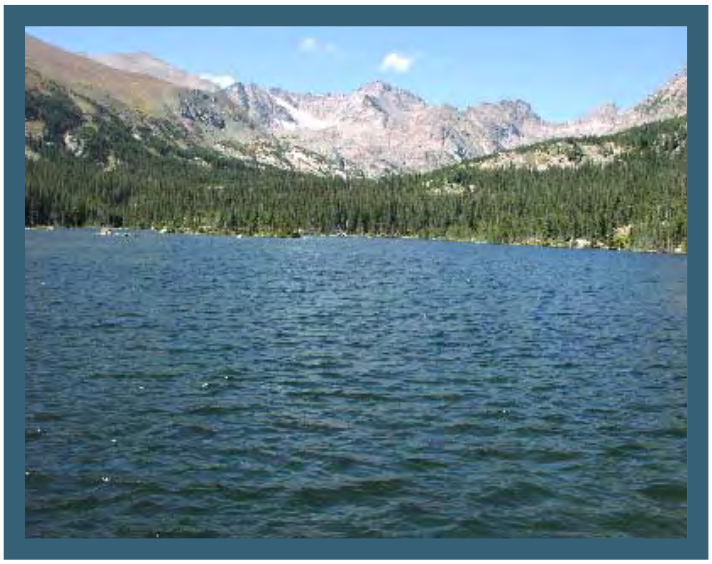
WHAT IS BOULDER'S SOURCE WATER SYSTEM?

Boulder's water supply system includes many storage, conveyance, hydroelectric and treatment facilities. The city owns approximately 7,200 acre-feet of reservoir storage space in the North Boulder Creek watershed, owns 11,700 acre-feet of storage in Barker Reservoir on Middle Boulder Creek, and has up to 8,500 acre-feet of storage space in Boulder Reservoir. Boulder's two water treatment facilities are the Betasso Water Treatment Facility (WTF), with approximately 45 million gallons per day (MGD) of treatment capacity and the Boulder Reservoir WTF at about 16 MGD. The city operates eight hydroelectric plants located within the municipal water supply system and sells the electricity to Xcel Energy. Four of these hydro plants are located on raw water pipelines and four are on treated water transmission pipelines.

MISSION STATEMENT

The mission of the Utilities Division is to provide quality and reliable water services involving drinking water, wastewater, and stormwater and flood management that meet regulatory requirements and as desired by the community, in a manner which emphasizes efficient management of fiscal and natural resources, and protects human and environmental health.

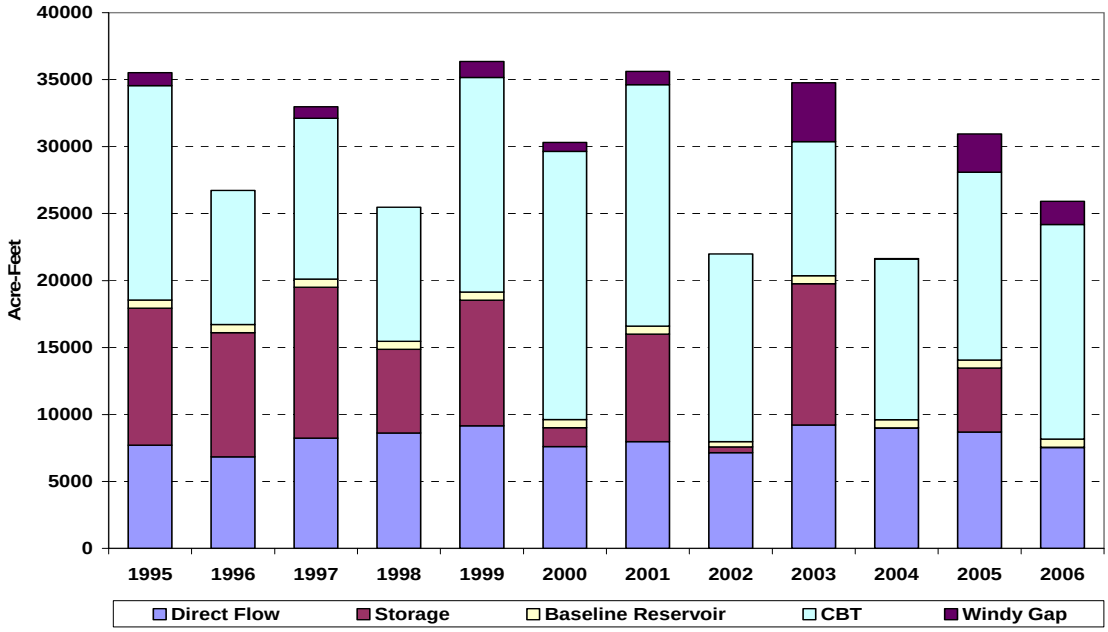
Operation of the city's water system involves intricate relationships between water rights, water quality, laws and legal agreements, streamflows, reservoir storage operations, transmission pipeline operations, treatment capacity, hydropower production, and water demands. The availability of sufficient water supplies to meet the city's needs is only assured by balancing and managing all of these factors.



SILVER LAKE WATERSHED

Boulder owns a diverse portfolio of water rights and water delivery contracts which allow the city to use water both from the local Boulder Creek basin and from tributaries of the Colorado River (**Figure 1**).

FIGURE 1. HISTORIC YIELDS OF BOULDER'S WATER RIGHTS AND SUPPLIES



The city's Middle Boulder Creek and North Boulder Creek water rights are fed by watersheds on the eastern slope just below the Continental Divide. Boulder also owns rights to delivery of water from the Colorado-Big Thompson Project (CBT) and the Windy Gap Project. Both of these projects divert water from the western slope and deliver it through the CBT facilities, which are operated by the Northern Colorado Water Conservancy District (NCWCD).

Like most western communities, Boulder depends on stored water most of the year. High streamflows from melting snowpack occur for only a few spring and summer months. Natural streamflows in late summer and the winter are not sufficient to meet customer demands and must be supplemented with previously stored water supplies. The amount of water available also changes from year to year depending on how much snow falls in the mountains. Therefore, Boulder must store water in reservoirs during wetter years to carry over for use in dry years. The city owns seven reservoirs and several natural lakes in the headwaters of the North Boulder Creek basin within the Silver Lake Watershed. In addition, the city owns Boulder Reservoir northeast of Boulder and the Barker Reservoir facilities on Middle Boulder Creek.

Boulder's source water facilities are depicted in **Figure 2**.

FIGURE 2. CITY OF BOULDER SOURCE WATER FACILITIES

Color Code

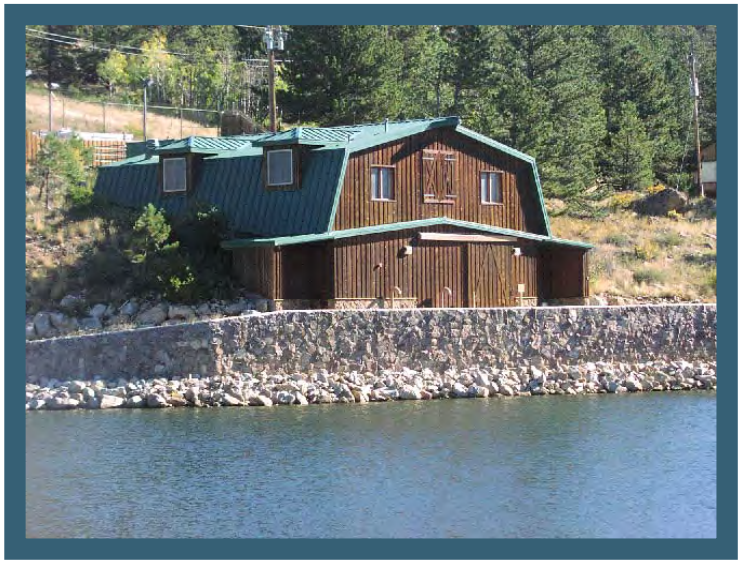
- Untreated Water Storage Reservoirs
- Raw Water Transmission Facilities and Diversion Structures
- Water Treatment Facilities
- Raw Water Hydroelectric Facilities

Skyscraper Reservoir
Albion Lake and Green Lakes Nos. 1, 2, and 3
Silver Lake Pipeline and Diversion Structure
Silver, Island, and Goose Lakes
Lakewood Reservoir, North Boulder Creek, and Como Creek Diversion
Park Reservoir Site
Caribou Ranch
Silver Lake Hydro
Lakewood Reservoir
Barker Reservoir
Boulder Canyon
Barker Gravity Line
Lakewood Pipeline
Boulder Canyon Hydro Penstock
Betasso Penstock
Kossler Reservoir
Betasso Water Treatment Facility
Boulder Canyon Hydro
Lakewood Hydro and Betasso Hydro
Orodell Hydro
Boulder Feeder Canal
Boulder Reservoir
Boulder Reservoir Water Treatment Facility
Baseline Reservoir
Wittemyer Ponds (east of the intersection of Hwy 52 and County Line Road)

Section 2

WHERE DOES THE SOURCE WATER MASTER PLAN START?

The current SWMP picks up where earlier planning efforts leave off. The city's previous Raw Water Master Plan (RWMP) was completed in 1988. In 1987, the city initiated a public process to evaluate the water supplies that Boulder owned and discuss options for use of the water. The RWMP focused more on water yield and water use in the city and less on raw water system infrastructure.



SILVER LAKE HYDROELECTRIC PLANT

Several of the recommendations in the RWMP were adopted for further action by the City Council. Many of these recommendations have been implemented over the past nineteen years. In addition, some changes that affect water supply have occurred since 1988 and new information is now available. Between the completed tasks recommended by the RWMP, changes that have occurred, and the availability of new information, it is an appropriate time to plan for the next 20 years.

One of the key findings of the RWMP was that the city owned sufficient supplies to meet its build-out water needs. Although this determination still appears to be valid, changes since 1988 might have affected this conclusion, either positively or negatively. This finding among others will be the subject of future evaluation. The current SWMP, development of which began in earnest during the summer of 2007, sets the course to evaluate the adequacy of the city's future source water supply with regard to quantity, quality, policies and the infrastructure that is the backbone of the system.

IMPLEMENTATION OF 1988 RWMP RECOMMENDATIONS

Many of the 1988 RWMP recommendations have been implemented:

- The city continues to maximize its exchange yields to maximize water available to the Betasso WTF and for hydroelectric generation in accordance with City Council direction at the time.
- The city has maintained or increased storage levels in the Silver Lake Watershed.
- The city maintains a storage reserve in its Boulder Creek basin reservoirs and has converted the Boulder Reservoir WTF to year-round operation.
- The city sold 43 of its original 80 units in the Windy Gap Project and used the proceeds to purchase additional shares in ditch companies, joint ownership with Boulder County of Caribou Ranch, and the Barker system. Purchase of the Barker system in 2001 has increased the city's water yield and provides additional hydroelectric generation.
- The city successfully postponed the construction of additional water treatment facilities until 2004 through its water conservation programs.
- A Drought Response Plan has been developed for short-term supply shortfalls caused by extreme drought or facility failure.
- The city has continued its Watershed Dam rehabilitation program to provide a safe, reliable water supply system.
- The city has replaced both the Silver Lake and Lakewood Pipelines and installed hydroelectric generation facilities on both pipelines.
- The city continues to rehabilitate and improve Barker system pipelines to increase system reliability.
- The city protects and enhances the aquatic and riparian ecosystems by providing water flows and managing the Boulder Creek instream flow program as an agent of the Colorado Water Conservation Board (CWCB).

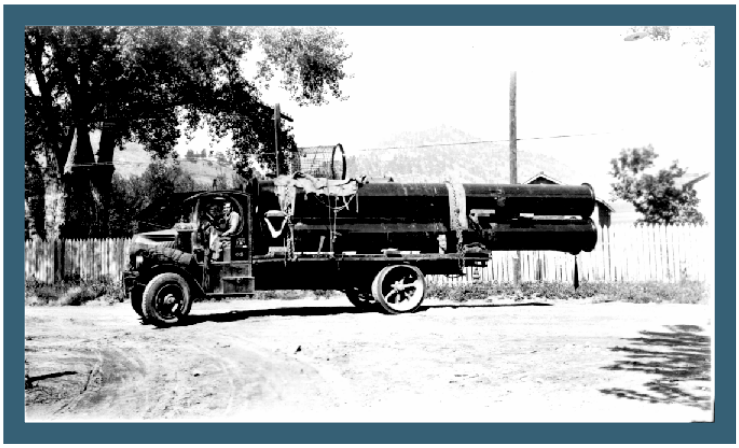
Many accomplishments have occurred and many things have changed since the 1988 RWMP was completed. The current SWMP effort acknowledges those accomplishments and changes and sets the course for future source water facilities, resources and policies.

Section 3

HOW WAS THE SOURCE WATER MASTER PLAN DEVELOPED?

The SWMP was developed by means of a collaborative process that involved input from the public, city staff and consultants. The source water system is complex and accordingly, the scope of the SWMP must be fairly broad in order to address all its important aspects. The source water system involves many different elements including water rights, water quality, supply and demand, infrastructure, city policy and land management. The system also involves numerous stakeholders and interested parties both within and outside city government. As such, a number of concurrent work efforts were required to develop the plan. The major tasks performed in development of the plan are as follows:

- Conducting a public process through formation of a community study group,
- Conducting a staff survey,
- Gathering and compiling a vast amount of existing information,
- Consideration of water availability, water use and water rights,
- Evaluation of the city's source water infrastructure,
- Preparation of a 20-year budget,
- Coordination between the SWMP and the Water Quality Strategic Plan, and
- Drafting and assembling the plan.



BOULDER'S EARLY PIPELINE CONSTRUCTION

The ***Source Water Master Plan Community Study Group (CSG)*** was formed on behalf of the City Manager as a working group of invited stakeholders representing a wide range of opinions and interests in the community. The CSG provided advice and input to the city staff and consultants preparing the SWMP. Both the Water Resources Advisory Board (WRAB) and City Council appointed liaisons to the CSG. The process was conducted with the assistance of two professional facilitators, Barbara Lewis and Jenny McCurdy from Catalyst Consulting.

The CSG initially developed and prioritized a list of important issues to be addressed by the group and in the SWMP. The project team then used the issues list to develop the topics to be addressed in subsequent meetings. A series of four meetings, which were open to the public, were held between September 2007 and February 2008. During those meetings, the topics addressed by the group were:

- Water availability
- Water use
- Watershed management
- CIP and proposed projects

The CSG developed a summary memo (Appendix A) with the assistance of the project team. It conveys to city staff the issues related to the city's source water system that were identified by the group and provides suggestions concerning actions for addressing those issues.

On behalf of the project team preparing the SWMP, MWH conducted a ***survey of city staff***. Forty nine individuals from different divisions and departments within the city participated in the survey.

Survey participants were asked, among other things, to identify the "top three to five" most urgent needs within the city's source water system. The survey resulted in 27 pages of information, including staff feedback and suggestions. A summary of the staff survey is provided in Appendix B.

Staff survey participants represented the following workgroups:

- Water Quality
- Water Resources
- Water Treatment
- Utilities Project Engineering
- Utilities Maintenance
- Parks and Recreation
- Open Space and Mountain Parks
- Planning
- City Attorney's Office
- City Manager's Office

Gathering and compiling a vast amount of existing information was one of the primary objectives of the SWMP. The goal was to compile descriptive and background information for the assets and resources which comprise the city's source water system so that the information is all in one place and is available for future operations. To the extent possible, existing reports and documents were gathered and summarized, including capturing important staff knowledge that had not been previously documented. This work effort was performed by city staff with assistance and drafting from consultants Kris Kranzush, Joanna Stansbury and June Busse.

An electronic file has been assembled with electronic versions of important documents and reports. This electronic file is included as an appendix to Volume 2 of the plan.

Development of the SWMP also included ***consideration of water availability, water use and water rights***. Yields of Boulder's water rights are influenced by streamflow supply conditions, demand from other water users and priority of the water rights. Operation of the city's water system involves intricate relationships between the city's water rights, water rights owned by others, water quality, laws and legal agreements, streamflows, reservoir storage operations, transmission pipeline operations, treatment capacity, hydropower production and water demands. There are many restrictions on what can be done with the city's water supplies based on legal or contractual constraints. Some of the city's water supply facilities have capacity or operational limitations. However, Colorado's semi-arid climate is the overriding influence on the choices made by the city when managing its water supplies.

Boulder owns a diverse portfolio of water rights and water delivery contracts which allow the city to use water both from the local Boulder Creek basin and from tributaries of the Colorado River to provide municipal water supply. These include direct flow rights, storage rights, exchange rights, and contract water delivery rights.

The SWMP evaluated the city's current water portfolio and the status of current modeling efforts, including climate change analysis.

Evaluation of the city's source water infrastructure and development of a 20-year budget was also an important objective of the SWMP. The effort was headed up by MWH, a Denver based water resources engineering firm who performed the following tasks:

- Toured major facilities with city staff,
- Reviewed existing documents and reports,
- Evaluated and followed up on staff survey comments,
- Developed budgetary cost estimates for capital projects and studies, and
- Prepared a 20-year budget..

Coordination between the SWMP and the Water Quality Strategic Plan was required because development of the two plans occurred concurrently and along parallel paths. The Water Quality Strategic Plan (WQSP) was led by the Water Quality and Environmental Services Group. There is some overlap between the two plans because the SWMP is focused on all aspects of municipal source water, including source water quality, and the WQSP looks at broader water quality issues including treated water, waste water, and stormwater throughout the city.

Because there is overlap between the SWMP and WQSP, during the CSG process the merit for separate source water and water quality plans versus a single plan was discussed. Points can be made for either approach, but the elements of water quality not pertinent to source water led the city to maintain development of separate plans. The CSG did identify issues and actions pertinent to the WQSP and that information was passed on to the Water Quality and Environmental Services Group.

The information gleaned from all of the above efforts has been assembled into two volumes including this summary plan and a detailed plan with appendices.

Section 4

WHAT POLICY RECOMMENDATIONS ARE IN THE SOURCE WATER MASTER PLAN?

The City of Boulder was incorporated in 1871 and has over time developed a stable administrative framework including policies that apply to management of the source water system. Recommendations in this section of the SWMP suggest minor adjustments and/or enhancements to the established policies. The SWMP document itself will not implement any new policies as these will require specific approval by the City Council or the City Manager and designated staff as is appropriate.

Policies implemented as a result of the RWMP continue to guide management of the source water system. In the past 20 years the city's water supply system has changed and new information is available. Therefore, it is an appropriate time to revisit the policies that will guide future source water management.

In addition, some of the SWMP recommendations for additional efforts and studies could have eventual policy implications. The specific direction such policies would take will not become apparent until the studies and plans are complete. **Table 1** presents only those policy recommendations for which near-term council direction is needed. These recommendations are described in more detail below.

TABLE 1. SOURCE WATER POLICY RECOMMENDATIONS

POLICY RECOMMENDATIONS	WATERSHED	SOURCE OF RECOMMENDATION	ISSUE(S) TO BE ADDRESSED
Continue taking reasonable steps to increase water supply reliability and system flexibility without causing negative economic impacts to the water utility.	System Wide	Staff	Water supply quantity
Reaffirm or modify current water supply reliability criteria.	System Wide	CSG	Water supply quantity
Formalize policy guiding the intended uses for conserved water.	System Wide	CSG	Water supply quantity and non-municipal uses
Develop source water protection policy or goals.	System Wide	Staff	Water supply quality
Do not pursue any further sales of Windy Gap water until studies re-evaluating its utility to the city are complete	Colorado River	Staff	Water supply quantity

System Flexibility (1) - With regard to system flexibility, the policy direction would be for the city to pursue "no-regrets" actions that would increase system reliability and flexibility in a way that provides value to the community and is sustainable for the future. No-regrets actions would be considered good now and still good if things change in the future. They would be actions that can be taken without unnecessary impacts to water rates.

Examples of potential no-regrets actions are as follows:

- Continuing to develop hydro power potential in an environmentally responsible manner where opportunities exist within the city's water system.
- Improving municipal water system facilities such as rehabilitating Green Lake #2 Dam to eliminate operating/storage-level restrictions.
- Pursuing non-municipal water use arrangements that avoid reliability impacts even if higher build-out water demand is realized or water yield is reduced by climate change. Interim arrangements could be considered until build-out demand is realized. Drought reservations could be established to minimize impacts if drought recognition thresholds are reached (e.g., allowing for instream flow pull-back in drought years). Future commitments to non-municipal uses must be flexible to assure municipal needs can be reliably met.
- Establishing downstream storage facilities to recapture instream flows for later exchange upstream for municipal and non-municipal uses.
- Recharging alluvial aquifers during high streamflow to increase returns to stream in low flow periods. Recharge facilities would be required for such a program.
- Assuming an acceptable funding/water rate plan can be accomplished, construction of Carter Lake Pipeline.
- Each project or program including the examples listed above would undergo its own approval process to determine whether or not it is cost effective and truly is a no-regrets action.

Reliability Criteria (2) - The CSG (2008) recommended revisiting public support for the current water supply reliability criteria policy, which expresses the city's goals for water supply during droughts of varying recurrence intervals. It was further recommended that in order to effectively define community preferences the reliability criteria need to be refined to define the embedded quantitative assumptions concerning indoor and outdoor water use. The current reliability criteria employ qualitative standards without defining the quantity of water necessary to meet those standards. "Essential needs," "exterior landscaping needs," and "all water uses" should be quantified to allow residents to reach an informed opinion concerning whether the current reliability criteria are acceptable or require adjustment. Do essential needs include enough water for residents to shower every day? Is viability of exterior landscaping limited to drought-resistant species only? These

SILVER LAKE DAM SPILLWAY

refinements would allow the community to more fully understand the impacts that could be expected under various drought conditions and determine whether the frequencies of restrictions allowed under the current criteria are acceptable.

Use of Conserved Water (3) - The CSG (2008) desired policy clarification on the intended uses for water made available by the city's water conservation efforts. Are we conserving water now to ensure that there will be sufficient supply available to support population and employment at build-out? Does the community's water conservation translate directly to long-term increased streamflow or water available for other non-municipal uses? A clear understanding should be developed for why we currently conserve water during non-drought years.

Source Water Protection (4) - The policy directive for this topic would be to actively pursue protection of the city's source water quality. Issues to be addressed might include wildland fire hazard mitigation, point and non-point source pollution and nuisance aquatic species. Land management strategies should be adopted in association with Nederland, Eldora Ski Area, Boulder County, CDOT and State and US Forest Services for Middle Boulder Creek Watershed Management.

The water source that supplies water to the Boulder Reservoir WTF includes both West Slope supplies and local drainage area contributing to the Boulder Feeder Canal and Boulder Reservoir. For the West Slope supplies, the city should support NCWCD and other CBT users in their development and implementation of source water protection strategies. The city should undertake a parallel effort with other stakeholders to protect the Boulder Reservoir and Boulder Feeder Canal water sources.

The North Boulder Creek Watershed consists of an upper and a lower basin. No recommended policy changes were identified for the upper basin. For the lower basin, however, the city should take an active role in oversight of activities associated with the Caribou Ranch Management Plan.

Windy Gap Units (5) - Although City Council did not recommend a permanent yield reduction of the city's water portfolio through sale of water in 1988, they did recognize that the Windy Gap water was the city's most expensive and least reliable water. Council recommended that staff attempt to reconfigure the city's water portfolio through sale of Windy Gap water and replacement of the Windy Gap water with water supplies and assets in the Boulder Creek basin that would be capable of multiple uses and would enhance the yield of existing systems. Based on these recommendations, the city sold 43 of its original 80 units. The proceeds were used to purchase the Barker system, additional shares in ditch companies, and joint ownership with Boulder County of Caribou Ranch. Purchase of the Barker system in 2001 has increased the city's water rights yield, increased operational flexibility, allowed improvements that increased system reliability, allowed for instream flows in Middle Boulder Creek and provided additional hydroelectric generation. Given uncertainties in future water yields due to potential climate change and other currently indefinable factors, policy direction concerning retention of the remaining Windy Gap units should be reevaluated and updated. Staff recommends not pursuing any further sales of the city's remaining Windy Gap units until a re-evaluation of the yield and utilities of this water is completed unless more attractive alternative water supply opportunities arise.

Section 5

WHAT ISSUES HAVE BEEN IDENTIFIED IN THE SOURCE WATER MASTER PLAN?

Source water system and facility issues were identified through:

- Facilities inspection and assessment,
- Review of historical city documents pertaining to facility condition,
- Staff survey,
- CSG discussions, and
- Additional information provided by Utilities Division staff.

Issues were grouped into the following general categories:

- Water rights yield issues,
- Water management and system operations issues,
- Water use issues,
- Watershed management issues, and
- Facility (physical infrastructure) condition and improvement issues.

The city must continue to protect its ***water rights yields*** to ensure that it can continue to meet the water supply reliability criteria. Key water rights yield issues include:

- Potential effects, if any, of climate change on the city's water rights yields,
- Possible uncertainties of future West Slope water supplies, and
- Farmers' Ditch capacity limitations.

Climate change science is at present relatively uncertain. Global circulation models (GCMs) have relatively large grid sizes that make detailed, local predictions uncertain. Carbon dioxide emissions scenarios also vary greatly. Just as many of the GCMs predict an increase in future average annual precipitation for the local watersheds as predict a decrease. With such uncertainty, the city is not in the position to take extensive actions to mitigate potential climate change effects. However, some changes that seem to be very probable are an increase in local average temperatures and the occurrence of earlier runoff mountain runoff and lower late summer flows in watersheds that supply Boulder's water. Reasonable and environmentally responsible measures to protect yields of the city's existing water rights, increase access to existing water supply sources, and enhance water system flexibility without causing negative economic impacts to the water utility should be taken during the interim period while current climate change uncertainties are resolved.

Hydrologic changes will also likely occur in the West Slope basins that supply a portion of the city's water supply. A significant unknown factor that could affect approximately half of Boulder's water supply is changes that might be triggered in the administration of the Colorado River Compact due to decreased streamflow in the Colorado River basin. The resultant effects on Boulder's water system could range from an increased average water yield to a decreased average yield depending on the timing of seasonal streamflow changes and their interaction with the city's ability to make streamflow diversions in priority under Colorado's water administration system.

A current water right allows the city to use 12.17 cfs of Farmers Ditch water for municipal use at times when it is not needed to maintain instream flow in Boulder Creek. The city has made limited use of this water right because of ditch capacity limitations above Boulder Reservoir. Restoration of ditch capacity would allow Boulder to use additional yield of approximately 988 acre-feet per year. This additional yield would be very reliable due to the seniority of the water right and would reduce Boulder's need to use its CBT supplies. Modeling studies have shown that CBT supplies can become a critical limiting factor during extended droughts.

The city's highest priority ***water management and system operations*** issues at the current time are:

- Maintaining operational flexibility to address variability in annual water supply,
- Source water system emergency planning, and
- Maintenance and staffing needs.

By design, the source water system components work together to produce the total system yield. Some parts of the system will be used more extensively than other parts in different years depending on the hydrology in that particular year. The high variability in annual water supply has created the need for flexibility in water management and system operation to provide reliable water supply through extended drought periods. Flexibility in system operations will likely become even more important in the future due to climate change effects.

The seasonal operation of the Boulder Feeder Canal limits flexibility of the city's operations and may limit the city's drought-year water yield. The ability to access West Slope source water during the winter would maximize use of this source and may be necessary to fully utilize the city's Windy Gap water. The city's use of West Slope water during the winter is currently limited by the amount of storage space available to the city in Boulder Reservoir under the contracts with NCWCD. The ability to store water in Boulder Reservoir during the winter is further limited by the need to maintain winter water levels below the point where high winter winds can damage the rip-rap on the dam and cause erosion. While improvements to the Boulder Reservoir Water Treatment Facility have been discussed as an alternative to the proposed Carter Lake Pipeline, an expansion of the water treatment facility capacity would not eliminate Boulder Reservoir's storage limitation. Full winter use of the currently planned 16 MGD capacity at the Boulder Reservoir Water Treatment Facility would require more water than can be stored in the city's Boulder Reservoir accounts during the winter. Without the ability to access West Slope water directly from Carter Lake during the winter to supplement what can be stored in Boulder Reservoir, the city will be unable to fully use the 16 MGD capacity of the Boulder Reservoir Water Treatment Facility on a year-round basis and may be unable to fully use its allocation of West Slope water in drought years.

The city's highest priority operations, maintenance and staffing issues are:

- Documentation of standard operating and maintenance procedures
- Development of maintenance schedules for source water facilities
- Documentation of inspections and facility maintenance needs

The exchange mechanism provides an important function in maintaining operational flexibility within the city's source water system. The exchange mechanism is used to continue taking water during the critical spring and summer high flow periods when water is physically available at the high mountain reservoir and pipeline diversion points in years when the city's native basin water rights are called out by more senior water rights. This is accomplished by satisfying the other water rights with an alternative supply such as CBT water. The city does not need to use its exchange rights in every year, but in some years the city's upper reservoirs will only fill through use of the exchange. Use of the exchange rights enhances drought protection, reduces the water utility's capital and operating expenditures and provides for renewable, hydroelectric power generation which reduces greenhouse gas emissions. In deciding the current and future balance between East Slope and West Slope water supplies and in reevaluating the current state of Boulder Creek's fisheries habitat, the city must consider the value of exchanges. Operational flexibility could become an issue with a reduction in the city's ability to use the exchange mechanism.

Notification and response planning is needed to ensure rapid, appropriate response to source water system and facility emergencies. Emergency response planning should evaluate risks to the water deliveries if there is a reduction in yield or quality of one or more of the city's water sources as a result of climate change, localized drought, compact call, wildland fire, infrastructure failure or contamination event. The plan should outline emergency response measures to be taken and define the city's ability to deliver water if a catastrophic event were to disable a portion of the source water system.

Operations, maintenance and staffing needs were gathered through staff survey responses as well as direct information from city staff. The overall response from the survey was that operation and maintenance have been steadily improving over the last 10 years, but that the city is lacking staff, training, and tools to be able to follow a maintenance plan. Well trained technical staff is needed to maintain the more technical equipment and computer systems that have been and are being added to the system.

While most source water facilities are informally inspected on a fairly regular basis, inspections are not formally documented. Documentation and communication of developing facility problems and needs is necessary to ensure adequate budgets can be developed to address problems in a timely and efficient manner. Standard operating procedures, maintenance schedules and inspection reporting processes are needed for all source water facilities.

At present, the city can meet its water supply reliability criteria while providing for some discretionary uses of water that is not needed for municipal use. ***Non-municipal water uses*** examined in the master planning process include:

- Instream flow protection,
- Hydropower,

- Agricultural leasing,
- Flow-based recreation, and
- Environmental enhancement.

TROUT INHABIT BOULDER CREEK

In some years, the city's water supplies exceed the municipal demand. In these years, there are opportunities to use the city's excess water supply for other purposes. In some cases, there are multiple potential beneficial uses of the water, some of which can be fulfilled at the same time, or some that can be fulfilled to a higher degree by reducing the amount of water dedicated to another purpose. For instance, water that is used for instream flow can in some cases be used downstream for agricultural irrigation.

As the city nears build-out, more and more of its water supplies will need to be committed for municipal use. Priorities among non-municipal uses may need to be established as the amount of water available for discretionary use declines.

North, Middle and main Boulder Creeks currently have a formal or informal instream flow program which maintain a wet stream year round subject to drought or emergency reservations, but the fisheries habitat studies are due to be reevaluated to determine the effectiveness of the program. South Boulder Creek is not part of the city's source water system. However, it is part of the Boulder Creek watershed, and its ecosystem is important to residents of the city. From November to mid-April, there are flow deficits in South Boulder Creek between Gross Reservoir and South Boulder Road.

The generation of hydropower along with operation of the city's municipal water supply system is in agreement with the policies established in the city's Climate Action Plan (2006). The city currently operates its hydropower facilities with its municipal diversions and water deliveries and does not make substantial excess diversions for the purpose of generating hydropower alone. The city has the potential to generate hydropower in excess of municipal diversion needs at the existing Boulder Canyon Hydro and Silver Lake Hydro and will soon have the capability for additional generation at Lakewood and Betasso Hydros. There are additional opportunities for hydropower development that historically have not been considered economically feasible, but values other than economics alone could potentially affect decisions concerning if and when additional generation at existing facilities or new projects are implemented. Historically, economic justification has been the overriding criterion and thus has been the issue that has eliminated some new projects. The potential for streamflow reductions has been the issue that has thus far influenced decisions to avoid some operational changes that could increase hydropower generation.

On a year to year basis, the city leases water to various individuals and ditch companies north and east of Boulder for irrigation. The agricultural leasing program is conducted on a year-by-year basis after fulfillment of the city's municipal needs and instream flow commitments. The city's leasing policy

has been to meet the needs of irrigators in District 6 first, then lease any additional water to other users.

The city has a goal of maintaining the existing flow regime to allow for flow levels sufficient for recreational kayaking and tubing on Boulder Creek from Eben G. Fine Park to 75th Street in the month of June during normal to above-normal flow years. The flows desired for recreational use represents a large quantity of water. A 24-hour period of flow within the kayaking range is equal to about 10 days of water supply for the entire city. Therefore, the city has little ability to increase recreational flows without jeopardizing municipal supply.

The maintenance of municipally-owned ponds and wetlands could potentially be improved by the city in terms of physically improving water supply and using water rights for this purpose. Supplementing flows to ponds or through wetlands is dependent on availability of excess water beyond what is required for municipal and other competing non-municipal uses. If municipal water or municipal water rights are dedicated to environmental enhancements, they will be taking away from other uses or drought protection, so priorities must be established. The city can annually lease surplus water to fulfill needs identified at Viele Lake and Thunderbird Lake.

Several city parks currently irrigated with treated water could be converted to a raw water irrigation system, which would reduce treated water demand. Parks for which development of a raw water irrigation system is feasible must be located near an irrigation ditch or lateral in which the city owns water rights or could obtain water rights inexpensively. Striking the balance between agricultural leasing, flow-based recreation, and environmental enhancement among other things will continue to be an issue in considering future non-municipal uses.

As a landowner and water manager, the city, through its water utility conducts various ***watershed management*** activities and coordinates extensively with other city and county departments as well as outside organizations in the planning and execution of these activities. Watershed management issues include monitoring and managing:

- Contamination sources,
- Wildland fire risks in the source water watersheds,
- Invasive and non-native species, and
- Habitat protection and land management policy.

Watershed management activities are geared toward protecting the quality of the city's waters for drinking water safety and to keep the costs of water treatment to a minimum. In addition, these activities maintain the functionality of facilities and enhance habitat.

Maintenance and rehabilitation of physical infrastructure will be an important priority over the next 20 years. One of the important outcomes of the SWMP was identification of ***facilities condition issues*** including needed repairs, improvements, modifications and upgrades to existing

The city's highest priority watershed management issues are:

- Invasive species in Boulder Reservoir because of the recent introduction of zebra and quagga mussels to Colorado
- Pine beetle and increased wildland fire danger
- Commercial, industrial, agricultural and herbicide runoff to the Boulder Feeder Canal
- Urban runoff and wastewater discharge from Nederland into Barker Reservoir

facilities. Needed repairs/improvements were categorized as high, medium or low priority. Each facility was also categorized in terms of importance to the source water system. Facilities with medium to high importance and medium or high needs were identified as needing capital or other improvements within the next 20 years. These facility conditions are summarized in **Table 2**.

TABLE 2. SUMMARY OF FACILITY CONDITION AND CRITICAL POSITION IN WATER SUPPLY

PROJECT	CRITICAL TO WATER SUPPLY	FACILITY REPAIR/PROJECT NEED
Watershed dam valves	**MEDIUM** – watershed dams are each a small part of overall supply	**HIGH** – some (not all) of the watershed valves are old with limited life spans
Green Lake #1	LOW – small volume, upstream of several other reservoirs	**HIGH** – outlet is not functional
Green Lake #2	LOW – small volume, upstream of several other reservoirs	**HIGH** – dam structure not functional
Albion Dam	**MEDIUM** – moderate volume, upstream of Silver Lake	**MEDIUM** – downstream face in poor condition and will continue to degrade
Goose Dam	**MEDIUM** – moderate volume, upstream of Silver Lake	LOW – dam is fully functional, operator access and operations could be improved
Island Dam	**MEDIUM** – small volume, but has 1890 senior water right	**HIGH** – concrete on crest needs immediate repair
Silver Lake Dam	**HIGH** – large volume, critical location at bottom of Silver Lake system	LOW – dam generally in good condition, bypass for low flows and mechanical operation could be improved
Lakewood Dam	**MEDIUM** – water can be supplied to Betasso via the Silver Lake Pipeline bypass to Lakewood Pipeline	LOW – appears to be in good condition, although reported cracks should be evaluated
Silver Lake Diversion	**MEDIUM** – water can be supplied to Betasso from Lakewood Reservoir via North Boulder Creek	LOW – generally functional with some problems due to freezing
North Boulder Creek Diversion to Lakewood Pipeline	**MEDIUM** – water can be supplied to Betasso via the Silver Lake Diversion	LOW – generally functional, but not ideal due to freezing issues and low flow measurement issues
Lakewood Pipeline	**HIGH** – one of three major water supply conduits in Boulder's system	LOW – there are known weld flaws, but regular inspection program is followed
Skyscraper Dam	LOW – critical to supply, but not until build-out	**HIGH** – valve and dam repairs are needed for future operation
Barker Dam	**HIGH** – large volume, critical storage component of system	**MEDIUM** – dam structure is sound, but outlet works need improvement
Barker Residence	LOW – not a component of water supply	LOW – location is not ideal for reservoir operations
Barker Canyon Hydro System Permitting	**MEDIUM** – water supply operations could continue without use of hydro facilities	**HIGH** – permit needed for continued operation of hydro facilities
Barker Gravity Pipeline	**HIGH** – one of three major water supply conduits in Boulder's system	**HIGH** – advanced age and poor condition could result in need to take offline
Middle Boulder Creek Weir	LOW – does not affect water supply	LOW – some sedimentation observed
Kossler Reservoir	**HIGH** – no bypass available	**HIGH** – degradation of main dam concrete panels, concrete cracking at outlet and seepage downstream
Boulder Canyon Hydro Penstock	**HIGH** – no bypass for this segment	LOW – recent visual inspection did not show any significant unexpected problems
Boulder Canyon Hydro	LOW – water can bypass hydro	**HIGH** – reaching end of useful life and concerns regarding operator safety
Boulder Feeder Canal	**HIGH** – one of three water sources in Boulder's system	**MEDIUM** – water quality concerns and seasonal limitations on use
Wittemyer Ponds	LOW – will be critical to supply closer to build-out demand	**MEDIUM** – will need substantial improvements for water exchange

Section 6

WHAT RECOMMENDATIONS AND NEXT STEPS ARE IDENTIFIED IN THE SOURCE WATER MASTER PLAN?

One of the goals of the SWMP is to develop recommendations for the city's source water management for the next 20 years, including evaluating costs and benefits as well as the timing of expenditures. The SWMP provides guidance on which future actions should be developed further through more specific efforts such as detailed studies, a project-specific CEAP, or development of capital projects. A number of recommendations have been developed as a result of work efforts associated with this master plan. The recommendations presented herein have been developed with input from the following sources:

- City Utilities Division staff and consultants involved in developing the master plan,
- SWMP CSG, including members of the Water Resource Advisory Board and City Council, and
- A survey of selected city departments and staff members.

Two sources of recommendations, the CSG and the staff survey, included detailed discussion and recommendations, some of which were beyond the scope of this master plan. With regard to the CSG, a final memo (CSG 2008) was prepared containing a summary table of recommendations that the group and staff agreed should be brought forward in the master plan. This chapter is intended to convey the recommendations contained in that table.

The staff survey contained numerous pages of comments and input from selected city departments and staff members. In general, the SWMP brings forward recommendations that received the most emphasis from surveyed staff. Individual suggestions that do not appear in the SWMP will be followed up on separately.

The recommendations have been grouped into the following categories:

- Policy assessment,
- Facilities improvements, and
- Studies and plans.

The policy assessment section (see Section 5 above) addresses changes to existing policies or identification of the need for new policies. The facilities improvements section covers physical infrastructure needs. The studies and plans section discusses information needed for future source water system management decisions.

COMO CREEK DIVERSION CONSTRUCTION

The ***facilities improvements*** discussion is separated into two sections: 1) capital improvement projects and 2) minor projects. Each section presents a summary table of projects. A brief narrative description of each the projects is available in Volume 2 of the SWMP, the detailed plan. Capital improvement projects are those estimated at over $50,000, and minor projects are under $50,000. Capital improvement projects would be listed in the annual CIP and typically would require a formal approval process including a CEAP. Minor projects would likely be funded out of operating budgets and would not require a formal approval process.

Capital Improvement Projects - During development of the SWMP, source water facilities (physical infrastructure) were evaluated to identify needed improvements and modifications. Recommended capital projects are summarized in **Table 3**. Prioritization is based on staff's judgment of the facility condition and how important the facility is to the water supply system (see **Table 2**). In most cases the priorities established by staff are representative of the feedback received from stakeholders involved in the SWMP process. However, for some items, opinions on priority varied significantly among stakeholders and the priority established by staff does not represent the breadth of opinions on such items. Priority 1 projects should be completed in the next six years. Priority 2 and 3 projects should be completed in years 7 to 20 and after 20 years, respectively. Top priority improvements have been indicated in bold type in **Table 3**.

Estimated project costs and timing are shown in the 20-Year CIP (**Table 6**). Actual cost opinions in January 2008 dollars are included as appendices to Volume 2.

The WRAB and the CSG recommended that the CIP be expanded to a 20-year period to allow for evaluation of proposed near-term expenditures against long-term capital project needs and the timing of expenditures. The 20-Year CIP is included at the end of this chapter as **Table 6**.

City staff recently updated the water system security vulnerability assessment. Based on this assessment, costs for recommendations for security vulnerability improvements have been incorporated in the 20-year CIP presented in **Table 6**. The security measures are considered confidential and have not been expressly described in the SWMP.

TABLE 3. LIST OF CAPITAL IMPROVEMENT PROJECTS AND PRIORITY

Item #/ Funding Plan	Project	Priority	Project Description
North Boulder Creek Water Source			
1a/AP	Green Lake #2 Engineering Evaluation	1	Evaluation of dam structure and study to determine best method and likely cost for repairs
1b/AP	Green Lake #2 Structural Maintenance	2	Structural maintenance to dam
2a/AP	Albion Dam Engineering Evaluation	2	Evaluation of dam structure and study to determine best method and likely cost for repairs or potential dam raise
2b/AP	Albion Dam Liner, Crest and Spillway Repair	2	a) Repair crest and spillway concrete b) Evaluate and potentially repair poorly cemented rubble below crest cap c) Apply membrane to upstream face to seal off seepage
2c/VP	Albion Dam Raise and Liner	3	Same as 2b with concrete dam raise
3/FCP	Island Dam Minor Repairs (patches)	1	Patches in 5 to 7 locations on upstream face and splash wall generally around high water mark
4a/FCP	Miscellaneous watershed valve replacement - Phase 1	1	Proactive valve replacement program in next 6 years
4b/FCP	Miscellaneous watershed valve replacement - Phase 2	2	Proactive valve replacement program for years 7 through 20
5/FCP	Lakewood Pipeline†	1	Ongoing maintenance recommended in 5th inspection report
Middle Boulder Creek Water Source			
6a/AP	Skyscraper Dam Evaluation and Gate Replacement	2	a) Video inspection of gates to create gate replacement plan b) Use diver to open gates to drain reservoir c) Replace gates and stem d) Evaluate dam structure to determine best method and cost for completing repairs
6b/AP	Skyscraper Reservoir Lining and Spillway Repair	3	Line reservoir and grout loose boulders on spillway
6c/AP	Barker Residence	2	Purchase a residence within sight of Barker Dam to improve access to and response time for operating the system
7a/FCP	Nederland WWTF Upgrade	1	Funds for advanced treatment at WWTF upstream of Barker Reservoir
7b/AP	Hannah Barker Hydro	2	Add hydro unit at toe of Barker Dam
7c/FCP	Barker Dam Outlet Works Replacement	2	Construction of vertical shaft near left abutment, inlet tunnels and one outlet tunnel, an outlet distribution facility, pipeline to Barker Gravity Line, and valve house
7d/FCP	Barker Dam anchor grout repair	1	Repair grout topping stabilization anchors (55 total)
7e/FCP	Barker Permitting	1	FERC Exemption and USFS Land Use Authorization
8a/FCP	Barker Gravity Line Land Exchange	2	Land exchange for Barker Gravity Line lands with the USFS
8b/FCP	Barker Gravity Pipeline Repair - Phase 1	1	Ongoing repair of sections with most critical needs
8c/FCP	Barker Gravity Pipeline Repair - Phase 2	2	Repair of remaining sections with less critical needs
9a/FCP	Kossler Reservoir Main Dam Repairs	1	Replace degraded concrete panels on upstream face

Item #/ Funding Plan	Project	Priority	Project Description
9b/FCP	Kossler Reservoir Minor Repairs	1	a) Maintenance of the seepage weir b) Determine capacity of overflow spillway c) Upgrade topographic surveys d) Hydraulic instrumentation and remote monitoring capability e) Tree growth control on north dam f) Gate house paint and lighting
9c/FCP	Kossler Outlet Repairs	1	a) Evaluate source of water downstream of road and implement appropriate fix b) Repair concrete damage at reservoir outlet and add seepage controls
9d/AP	Kossler Bypass	1	Connect Barker Gravity Line to Boulder Canyon Hydro Penstock
10a/AP	Boulder Canyon Hydro Penstock Evaluation	2	Study to evaluate need for replacement or targeted repairs with metallurgy and corrosion experts
10b/VP	Boulder Canyon Hydro Penstock Replacement	3	Eventual section by section replacement (if evaluation deems necessary)
10c/AP	Boulder Canyon Hydro Replacement	2	Replace with appropriately sized hydro unit
Colorado River Water Source			
11a/FCP	Boulder Feeder Canal Stormwater Diversions - Phase 1	1	Diversions of stormwater outfalls over canal described in Black & Veatch (2007)*
11b/AP	Boulder Feeder Canal Stormwater Diversions - Phase 2	3	Diversions of stormwater outfalls over canal described in Black & Veatch (2007)*
11c/AP	Carter Lake Pipeline	1	Construction of pipeline from Carter Lake to Boulder Reservoir for transbasin water supply
11d/VP	Carter Lake Pipeline Hydro	3	Hydro added upstream of Boulder Reservoir water treatment plant
12/VP	Farmer's Ditch Exchange Potential Pipeline	3	Low pressure pipeline from Boulder Reservoir to mouth of Boulder Canyon along Farmer's Ditch alignment.
13/AP	Wittemyer Ponds	2	Line Wittemyer ponds to use for exchange
14/AP	Farmers Ditch Capacity Restoration	2	Restore Farmers Ditch capacity sufficient to allow city to fully divert the conveyed 13.52 cfs during times when that water is not needed for instream flow

Priority Levels: 1 = next 6 years, 2 = next 7 to 20 years, 3 = long-term
Rows are shaded based on the Funding Plan: FCP = Fiscally Constrained Plan, AP = Action Plan, or VP = Vision Plan
†Maintenance efforts for Lakewood Pipeline are funded through a separate account from capital improvement projects
*Black & Veatch. (2007). Technical Memorandum 1. Boulder Reservoir Water Treatment Facility Source Water Contaminant Mitigation Costs. Dated August 21, 2007. Aurora, CO.

Other minor facilities improvement projects (each with a total cost less than $50,000) which could potentially be funded through an operating budget are summarized in **Table 4**. All minor improvement projects are included in the Fiscally Constrained Plan.

TABLE 4. LIST OF MINOR IMPROVEMENT PROJECTS AND PRIORITY (CAPITAL COST LESS THAN $50,000)

Item #/ Funding Plan	Project	Priority	Project Description
North Boulder Creek Water Source			
1/FCP	Green Lake #1 Outlet Repair	1	Repair non-functional outlet slide gate
2/FCP	Albion Dam Gage and Outlet Access	1	a) Install staff gage b) Install access to valve house patio
3a/FCP	Silver Lake Dam generator	2	Portable generator to electrically actuate valves and power lighting
3b/FCP	Silver Lake Dam bypass repair	2	Repair non-functional bypass for low flows
4a/FCP	Silver Lake Residence SCADA	2	Tie into the SCADA monitoring system with internet capability via satellite
4b/FCP	Silver Lake Residence and Bunk House roof replacement	1	Replace with metal roofs
5/FCP	Goose Dam control panel/actuator/ generator	1	Control panel on the top of the dam to actuate valves with portable generator
6/FCP	Instream flow gage installation - North Boulder Creek	2	Gage installation on North Boulder Creek at Sherwood Creek
7/FCP	NBC instream flow recording upstream of Lakewood	2	Redesign of current system to measure low flows
Middle Boulder Creek Water Source			
8a/FCP	Barker Dam floodgate conduit inspection	1	Video or manual inspection of floodgate conduits
8b/FCP	High water alarms upstream of Orodell	1	Alarms to warn of rapidly increasing flows
9/FCP	Kossler inlet erosion	2	Armor Barker Gravity Line outlet to Kossler Reservoir to prevent further erosion
Other Minor Projects			
10/FCP	Raw water irrigation systems	2	Develop raw water irrigation systems for city properties where feasible

Programs include recommended studies, environmental enhancements and other staff efforts. Programs would probably be funded as part of the capital improvement program or through annual operating budgets. Recommended programs are listed by water source followed by recommendations that pertain to system-wide efforts. Each of the recommended programs is discussed individually in **Table 5**.

TABLE 5. RECOMMENDED SOURCE WATER PROGRAMS AND STUDIES

Item #/ Funding Plan	Program/Study	Source	Issue(s) Addressed	Priority	Cost
North Boulder Creek Water Source					
1/FCP	Evaluate Lakewood Dam and report on the longitudinal cracks observed in 2001	Staff	Facilities condition	1 (within the next year)	$15,000
Middle Boulder Creek Water Source					
2/FCP	FERC Part 12D Inspection Report recommendations	Staff	O&M (Operations/ Maintenance)	1	$30,000
3/FCP	Collaborate with other entities to prepare a community watershed wildland fire protection plan for the Middle Boulder Creek basin	CSG	Watershed management wildland fire	1 (ongoing)*	$50,000
South Boulder Creek					
4/FCP	Assist the Open Space and Mountain Parks Department in developing an approach and organizational structure to provide instream flows in South Boulder Creek	CSG	Water use - instream flow protection	1	Staff Time
5/FCP	Explore options for use of Utilities assets within a comprehensive city program for improved instream flows on South Boulder Creek	CSG	Water use - instream flow protection	1 (ongoing)*	Staff Time
Colorado River Water Source					
6/AP	Continue to monitor developments on the Colorado River Compact. If the State study is inadequate, move ahead with other interested parties to conduct study of West Slope climate change impacts and mitigation option.	CSG	Water rights yields and protection	2	TBD
7/FCP	Take immediate action to prevent or delay the introduction of zebra and quagga mussels to Boulder Reservoir by improving oversight on recreation and coordinating with NCWCD	Staff	Watershed management and invasive/non-native species	1	Staff Time
8/FCP	Continue involvement in Boulder Feeder Canal trail design to reduce potential impacts to the water supply	Staff	Source water protection	1 (ongoing)*	Staff Time/FCP
9/AP	Work with the Parks and Recreation Department regarding planning for recreational uses on Boulder Reservoir	Staff	Source water protection	1 (ongoing)*	Staff Time/AP
10/FCP	Take an active role in NCWCD's activities to proactively protect the quality of West Slope water supplies	Staff	Source water protection	1 (ongoing)*	Staff Time/FCP
System-Wide					
11/FCP	Complete a source water emergency plan	CSG	Security, remote operation and monitoring	1	TBD/FCP
12/FCP	Update water demand projections based on BVCP and changes in demographic/water use projections	CSG	Water use - municipal use and conservation	1	$50,000
13/FCP	Complete modeling to define the level of reliability resulting from updated demand projections, water conservation savings and supply projections	CSG	Water use - municipal use and conservation	1	$100,000

Item #/ Funding Plan	Program/Study	Source	Issue(s) Addressed	Priority	Cost
14/FCP	Update water use and conservation studies/update 2003 drought plan[1]	CSG/WRAB	Water use - municipal use and conservation	1	$50,000/ $50,000
15/AP	Explore the pros and cons of long-term commitments to non-municipal water uses	CSG	Water use - non-municipal uses	2	TBD
16/FCP	Update aquatic habitat studies to assess effectiveness of current instream flow program and, if needed, evaluate options for providing enhanced habitat in sufficient detail to identify impacts, costs and benefits	CSG	Water use - instream flow protection	1	$100,000
17/AP	Evaluate environmentally and economically feasible hydroelectric sites within the water transmission system	CSG	Water use - hydropower	2	TBD
18/FCP	Develop a maintenance plan and corresponding maintenance logs for each water source to document daily and seasonal operations and maintenance needs.	Staff	Maintenance planning and execution	1 (ongoing)*	TBD
19/FCP	Evaluate the balance in reliance on East Slope and West Slope supplies and determine if a change in the balance would cause a need for new water supplies at build-out	CSG	Water rights yields and protection and balancing of water sources	2	TBD
TOTAL COSTS FOR PRIORITY 1 PROGRAMS					**$395,000**

Priority Levels: 1 = next 6 years, 2 = next 7 to 20 years, 3 = long term
Rows are shaded based on the Funding Plan: FCP = Fiscally Constrained Plan, AP = Action Plan, or VP = Vision Plan
*As information and opportunities arise

[1] The CSG recommended updating water use and conservation studies and the drought plan was based on WRAB input.

Section 7

HOW WILL THE RECOMMENDED PROJECTS AND PROGRAMS BE FUNDED?

The City of Boulder uses a "fund" accounting and budgeting system. Each fund is separate and distinct from the others. While programs and projects may be budgeted within or across funds, the monies must be accounted for in terms of balancing each fund. The Department of Public Works uses four types of funds in two categories to conduct most business: governmental (general fund and special revenue funds) and proprietary (enterprise funds and internal service funds). Water utility activities are budgeted primarily under the water utility fund, which is an enterprise fund.

Revenue earned by the city that is accounted for within the water utility fund is mostly derived from water sales and fees for allowing taps into the city water system (**Figure 3**). City utility rates and fees are computed through an analysis of revenues compared to expenditures. Increases in future budgets are primarily due to recommended replacements and additions, growth and inflationary conditions. Projections of revenue are based on the estimated future number of customers to be served.

City master plans strive to categorize projects and programs as:

Essential – programs, services or facilities essential to ensuring the health and safety of the people and property in the community and municipal corporation.

Desirable – services that enhance programs or facilities in ways that advance desired community values.

Discretionary – creates or maintains discretionary services/facilities that serve limited purposes or specialized interests.

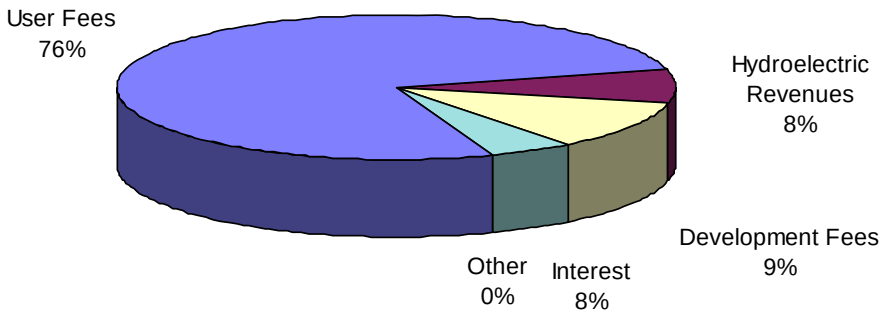
Following the above categorization, master plans typically include discussion of budgets and funding plans according to three categories below.

Fiscally Constrained Plan - includes items that are currently funded.

Action Plan - includes the next steps that should be taken when funding is available to either restore or expand services.

Vision Plan - Is the complete set of desired services.

FIGURE 3. WATER UTILITY FUNDING SOURCES (2009 CIP)



The SWMP looks at recommended replacements and additions in the form of capital projects and programs for the next 20 years. Capital, operating and maintenance costs associated with the source water system as well as other elements of the water utility (e.g. water treatment, distribution, etc.) are considered in the normal city budgeting cycle. Impacts on water rates as well as timing of expenditures have also been considered. The recommended projects and programs in the SWMP will have to abide all of the applicable regulations, ordinances and charter provisions, including enterprise status restrictions and TABOR constraints.

The city provides water, sewer and stormwater services by virtue of Article XX of the State Constitution (Home Rule of Cities and Towns) and the City Charter. The Utilities Division of the Public Works Department directs the day to day operations of the three utilities. The city operates its water, sewer, and stormwater systems as individual "enterprises" as defined in Article X, Section 20 of the State Constitution and Section 11-1 of the City Code.

Section 8

WHAT PERFORMANCE MEASURES WILL BE USED TO MONITOR THE PLAN'S SUCCESS?

The water utility's performance in managing the source water system can be measured in general by answering the following primary questions:

1. Does the city have enough water to meet short and long-term demand?
2. Is the source water of sufficient quality for treatment and distribution?
3. Is the source water infrastructure reliable?
4. Are water utility rates reasonable?

The Boulder Valley Comprehensive Plan (BVCP) provides measurement standards and criteria for the overall performance of the city's management of the source water system. The reliability criteria adopted by City Council in 1989 provide measurement standards for the water supply quantity. Federal and State standards provide a means for monitoring water quality. The city's annual budget approval process provides a means for managing water rates.

The BVCP provides urban service criteria and standards (see inset) that provide overall guidance on how the above questions get answered. The urban service criteria and standards speak to quantity, quality and infrastructure reliability and costs. The source water system currently meets the urban service criteria and standards presented in the BVCP. Recommended studies, programs and capital improvement projects have been identified to ensure that the source water system will continue to meet the service criteria in the future.

Since 1970, the city and Boulder County have jointly adopted a comprehensive plan that guides land use decisions in the Boulder Valley. The facilities and services section of the Boulder Valley Comprehensive Plan (BVCP) establishes policies linking growth to service standards and provisions found in the Source Water Master Plan and other master plans. The BVCP describes water resources protection policies for the following items.

- Protection of Water Quality
- Water Resource Planning
- Drinking Water
- Minimum Flow Program
- Protection of Aquifer and Groundwater Recharge Areas
- Pollution Control
- Discouragement of Private Sewage Systems

The SWMP and its recommended projects and studies are consistent with the goals, policies and growth projections of the BVCP.

The reliability criteria adopted by City Council in 1989 provide a means for measuring the adequacy of the city's water supply quantity. The reliability criteria are as follows:

For those water uses deemed essential to the maintenance of basic public health, safety and welfare such as indoor domestic, commercial, industrial uses and firefighting uses, the city will make every effort to ensure reliability of supply against droughts with occurrence intervals of up to 1,000 years.

For the increment of water use needed to provide continued viability of outdoor lawns and gardens, the city will make every effort to ensure reliability of supply against droughts with occurrence intervals of up to 100 years.

The BVCP contains urban service criteria and standards. Excerpts from the standards that apply to the source water system are as follows:

- Public Water
  - Responsiveness to Public Objectives
  - Provide a sufficient degree of reliability for raw water, treated water, and an efficient transmission/distribution system capacity to meet the demands of the population 24 hours per day.
  - Provide full-time personnel 24 hours per day at the water treatment plant to assure water quality, monitor equipment and make emergency repairs.
  - Have personnel on call 24 hours per day for water service emergencies.
- Sufficiency of Financing
  - Have revenue sources that are guaranteed so that revenues are available for water related materials, capital improvement projects, equipment, facilities and personnel.
  - Use Plant Investment Fees as possible revenue for water rights acquisition, raw/treated water storage, treatment plant improvements/expansions and construction of water mains.
  - Be organized to request and receive state, federal, and Northern Colorado Water Conservancy District funds, when available, for equipment, facilities and projects.
  - Have the ability to obtain financing through the use of revenue bonds.
- Operational Effectiveness
  - Use annual budget for personnel, equipment, projects, facilities and materials.
  - Meet standard specifications as exemplified by the American Water Works Association.
  - Meet or surpass acceptable levels of federal and state water quality standards.
  - City of Boulder Design and Construction Standards should be used for standards for water main design for the Boulder Valley.
- Location and Adequacy of Equipment and Facilities
  - Have capacity to deliver sufficient treated water to maximum day demand conditions.
  - Have existing treatment plant capacity with planned expansion that will be capable of serving projected population of the Service Area.
  - Plan and provide treatment capability to meet required water quality standards.
  - Provide essential equipment and vehicles for water maintenance activities and emergency use.

For the increment of water needed to fully satisfy all municipal water needs, the city will make every effort to ensure reliability of supply against droughts with occurrence intervals of up to 20 years.

During the CSG meetings further refinement of the reliability criteria was discussed and identified as potentially warranting evaluation.

One of the fundamental principles of protecting drinking water is to draw raw water from the cleanest sources available to avoid having to remove contaminants and pathogens that might have otherwise been prevented from ever entering the water supply. Key indicators of water quality are monitored by the city at various locations in the source water system to identify changes that could indicate quality issues. Ultimately, the measurement criteria for drinking water quality, which starts at the source, is based on comparison with drinking water standards.

Colorado drinking water regulations include the National Primary Drinking Water Standards (NPDWS) that consist of all regulated contaminants and the Maximum Contaminant Level (MCL) or the Treatment Technique (TT) that must be met for each contaminant in drinking water supplies. In addition to the NPDWS list of contaminants, US EPA maintains a list of National Secondary Drinking Water Standards, which are non-enforceable guidelines for contaminants that may cause cosmetic or aesthetic effects in drinking water. Colorado recommends secondary standards to water systems as "reasonable goals" but does not require compliance.

The Capital Improvements Program schedules the necessary capital projects to ensure maintenance of an adequate range of urban services within Area I and to provide urban facilities and services to Area II through annexation on a phased and orderly basis over the 20-year planning period reflected in this plan. The timing of capital improvement projects within the source water system recognizes the need to expand facilities to ensure that the reliability criteria can continue to be met as build-out population and employment levels are approached.

> The first year's program in the CIP is adopted by the City Council as the Capital Budget, as a counterpart to the annual Operating Budget. Even though fiscal resources are appropriated only in the first year of the CIP, the succeeding five years of the CIP are important in providing a long-term plan for setting spending priorities, scheduling projects in a logical sequence, and coordinating and targeting CIP projects for all city departments. Each year the CIP is updated by adding a new sixth year of capital improvement projects. Adjustments are made to costs and revenues forecasted the previous year. Changes may also be made to the year(s) in which a project is scheduled, reflecting changes in fiscal conditions and changes in overall funding priorities. New capital projects may be added or deleted based on new facility needs identified in updated or new city master plans, area plans, or studies. Capital improvements also may be on-going line items to address continual capital needs.

Regarding water utility rates, each spring city departments develop and submit specific information on projects for the six-year CIP to the Planning Department. This information includes project descriptions, justifications, discussion of project goals, and estimates of project costs. A determination is made by the individual departments on what CIP projects are to be scheduled in the six-year time frame of the CIP. Funding priorities provided by master plans are either reaffirmed or modified at this stage. For major projects, funds for project planning, design, and construction are scheduled. This process provides a means for monitoring and managing water rates.

Section 9

WHAT DID THE SOURCE WATER MASTER PLAN ACCOMPLISH?

In concluding the final community study group meeting, the group was asked what the Source Water Master Plan would be known for in the future. Comments were:

- For addressing the questions, "Does Boulder have enough water" and "What do we do with it,"
- For the coalescence of the climate change issue. It is part of everything we do, and the plan will represent a comprehensive way of thinking,
- For getting the city serious on deciding on growth control,
- For being the first comprehensive planning document to deal with these issues,
- For cementing the City of Boulder's commitment to multiple uses,
- For providing better input to planning decisions concerning water impacts,
- For significantly advancing the ball in this era of sustainability,
- For providing a good plan for managing and maintaining source water facilities, and
- For addressing sustainability and City Council goals.

Only time will tell if the plan's implementation will achieve the above-described identity. However, during its creation, the SWMP did accomplish many of its objectives as follows:

- Assembled pertinent information about the source water system in one place,
- Summarized the current status of ongoing climate change studies, which indicate that Boulder currently appears to have adequate water supply,
- Identified issues to be addressed in the source water system,
- Established a list and priorities of facilities needs as well as programs and studies to be accomplished in the next 20 years,
- Developed a 20-year CIP,
- Provided an opportunity (staff survey/community study group) for staff and other interested parties to help steer future management of the source water system, and
- Was prepared to be compatible with the BVCP and other master and strategic plans.

Through development of SWMP, the stage is set for the source water system to continue to operate reliably for the next 20 years and beyond. The project team is thankful to all who contributed to the plan.

TABLE 6. 20-YEAR CIP

Project Name	Total	Assumed Inflation Rate																							
		Estimated 2008 Cost	Actual	Revised	Recommended	Projected																			
			2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
SOURCE WATER TRANSMISSION SYSTEM																									
Lakewood Pipeline	**$28,699,718**		$248,828	$113,124	$100,000	$100,000	$0	$1,238,060	$0	$119,405	$0	$126,677	$0	$8,063,498	$0	$142,576	$0	$151,259	$0	$9,347,804	$0	$170,243	$0	$8,778,243	$0	$0
Source Water Transmission Pipe Inspections	**$160,000**		$0	$0	$80,000	$0	$0	$80,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	**$28,859,718**		*$248,828*	*$113,124*	*$180,000*	*$100,000*	*$0*	*$1,318,060*	*$0*	*$119,405*	*$0*	*$126,677*	*$0*	*$8,063,498*	*$0*	*$142,576*	*$0*	*$151,259*	*$0*	*$9,347,804*	*$0*	*$170,243*	*$0*	*$8,778,243*	*$0*	*$0*
BARKER WATER SYSTEM																									
Barker Gravity Pipeline Repair	**$22,610,041**	$20,000,000	$907,699	$777,664	$360,500	$371,315	$382,454	$393,928	$405,746	$417,918	$922,405	$950,078	$978,580	$1,007,937	$1,038,175	$1,069,321	$1,101,400	$1,134,442	$1,168,476	$1,203,530	$1,239,636	$1,276,825	$1,315,130	$1,354,583	$1,395,221	$1,437,078
Barker-Kossler Penstock Repair	**$135,466**	$100,000	$4,989	$0	$0	$0	$0	$0	$0	$0	$0	$0	$130,477	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Barker Dam Outlet	**$799,448**		$18,540	$0	$0	$0	$0	$0	$0	$780,908	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Barker Dam Outlet - Bond Proceeds	**$7,809,084**	$7,055,000	$0	$0	$0	$0	$0	$0	$0	$0	$7,809,084	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Barker Dam	**$430,456**	$350,000	$0	$0	$0	$0	$0	$0	$0	$0	$430,456	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Barker Hydro System Integration	**$178,239**		$76,994	$101,245	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Barker Relicensing	**$1,769,486**		$116,132	$400,000	$1,000,000	$0	$0	$0	$0	$0	$0	$253,354	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Barker Instream Flow Release	**$58,824**		$58,824	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Betasso Penstock	**$3,361,383**		$272,671	$3,088,712	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Barker Source Water Protection	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Kossler Reservoir	**$1,300,451**	1,200,000	$0	$0	$0	$360,706	$939,745	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	**$38,452,879**		*$1,455,849*	*$4,367,621*	*$1,360,500*	*$732,021*	*$1,322,200*	*$393,928*	*$405,746*	*$1,198,827*	*$9,161,945*	*$1,203,432*	*$1,109,057*	*$1,007,937*	*$1,038,175*	*$1,069,321*	*$1,101,400*	*$1,134,442*	*$1,168,476*	*$1,203,530*	*$1,239,636*	*$1,276,825*	*$1,315,130*	*$1,354,583*	*$1,395,221*	*$1,437,078*
RAW WATER STORAGE RESERVOIRS																									
Albion Dam	**$4,203,415**	$3,075,000	$0	$0	$0	$0	$0	$0	$0	$0	$92,241	$0	$0	$373,743	$3,737,431	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Silver Lake Dam	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Island Lake Dam	**$108,150**	$105,000	$0	$0	$108,150	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Green Lake 1 Dam	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Green Lake 2 Dam	**$4,995,502**	$3,875,000	$0	$0	$0	$0	$0	$0	$86,946	$0	$0	$446,232	$4,462,324	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Green Lake 3 Dam	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Goose Lake Dam	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Boulder Reservoir	**$128,318**	$90,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$128,318	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lakewood Reservoir	**$137,751**	$102,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$137,751	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Skyscraper Dam	**$167,990**	125,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$167,990	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Wittemyer Ponds	**$6,032,736**	4,000,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$587,413	$5,445,323	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	***$15,773,863***		*$0*	*$0*	*$108,150*	*$0*	*$0*	*$0*	*$86,946*	*$0*	*$92,241*	*$446,232*	*$4,462,324*	*$679,484*	*$3,737,431*	*$128,318*	*$587,413*	*$5,445,323*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
OTHER RAW WATER FACILITIES																									
Farmer's Ditch	**$122,987**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$122,987	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Anderson Ditch	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Watershed Improvements	**$688,610**	$440,500	$0	$0	$0	$0	$317,437	$0	$0	$0	$92,241	$0	$0	$0	$0	$106,932	$0	$0	$0	$0	$172,000	$0	$0	$0	$0	$0
Nederland WWTF	**$300,000**		$0	$0	$300,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Instream Flow Structures and Gaging	**$50,000**		$0	$0	$0	$0	$50,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Como Creek Diversion Structure	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Lakewood Diversion Structure	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Silver Lake Diversion Structure	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
NCWCD Conveyance - Boulder Feeder Canal	**$739,623**	$283,000	$98,636	$340,752	$0	$300,235	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
NCWCD Conveyance - Carter Lake Pipeline	**$3,936,618**		$131,250	$1,118,750	$0	$0	$0	$0	$2,686,618	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
NCWCD Conveyance - Bond Proceeds	**$26,866,177**		$0	$0	$0	$0	$0	$0	$0	$26,866,177	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Project Name	Total	Assumed Inflation Rate																							
		Estimated 2008 Cost	Actual	Revised	Recommended	Projected																			
			2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Subtotal	***$32,704,014***	*$25,000,000*	*$229,886*	*$1,459,502*	*$300,000*	*$300,235*	*$367,437*	*$0*	*$2,686,618*	*$26,866,177*	*$92,241*	*$0*	*$0*	*$0*	*$122,987*	*$106,932*	*$0*	*$0*	*$0*	*$0*	*$172,000*	*$0*	*$0*	*$0*	*$0*	*$0*
SOURCE WATER PRV, PUMPING AND HYDRO																									
Lakewood Hydroelectric	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Silver Lake Hydroelectric	**$0**		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Boulder Reservoir Intake and Pumping	**$100,000**		$0	$0	$100,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Betasso Hydro PRV Station	**$215,826**		$0	$215,826	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Barker Dam Hydro	**$3,652,725**		$0	$0	$0	$0	$0	$0	$0	$0	$3,652,725	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Boulder Canyon Hydro	**$7,766,278**	$3,300,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,766,278	$0	$0
Source Water Pressure Reducing, Pumping and Hydroelectric Facility Rehabilitation	**$4,402,900**	$4,300,000	$0	$0	$0	$0	$0	$0	$0	$0	$218,432	$224,985	$231,734	$238,686	$245,847	$253,222	$260,819	$268,643	$276,703	$285,004	$293,554	$302,360	$311,431	$320,774	$330,397	$340,309
Subtotal	***$11,734,830***		*$0*	*$215,826*	*$100,000*	*$0*	*$0*	*$0*	*$0*	*$0*	*$3,871,157*	*$224,985*	*$231,734*	*$238,686*	*$245,847*	*$253,222*	*$260,819*	*$268,643*	*$276,703*	*$285,004*	*$293,554*	*$302,360*	*$311,431*	*$8,087,052*	*$330,397*	*$340,309*

Appendix A

COMMUNITY STUDY GROUP SUMMARY MEMO

MEMORANDUM
March 21, 2008

TO: **Source Water Master Plan Project Team**

FROM: **Source Water Master Plan Community Study Group**

SUBJECT: **Report of the Source Water Master Plan Community Study Group**

INTRODUCTION

The Source Water Master Plan Community Study Group (CSG) was formed on behalf of the City Manager as a working group of invited stakeholders representing a wide range of opinions and interests in the community. The CSG provided advice and input to the city staff and consultants preparing the Source Water Master Plan (SWMP). Both the Water Resources Advisory Board (WRAB) and City Council appointed liaisons to the CSG. The group roster is contained in Appendix A of this report.

The CSG has developed this report with the assistance of the project team. It conveys to city staff the issues related to the city's source water system that were identified by the group and provides suggestions concerning actions for addressing those issues. Staff will transmit this report to the WRAB, Planning Board and City Council as the SWMP proceeds through the review process.

The CSG initially developed and prioritized a list of important issues to be addressed by the group and in the SWMP. The project team then used the issues list to develop the topics to be addressed in subsequent meetings. The topics addressed by the group were:

- Water availability;
- Water use;
- Watershed management;
- Capital Improvements Program and proposed projects.

A complete list of the specific issues identified within each category and the prioritization scores for the issues are included in Appendix B of this report (see Meeting Summary for CSG Meeting No. 1).

This report is organized in sections titled "Recommendations," "Process," and "Conclusions." The recommendations section is an overview of the CSG member comments on a preliminary tabulation of recommendations to potentially be included in the SWMP. Relevance to future decision-making is identified for each recommendation. The group also identified which recommendations should be considered "urgent" and therefore, pursued in the near-term.

The process section of the CSG report provides a summary of information provided by the project team and CSG discussions of each of the four topics listed above. The conclusions section includes group member opinions concerning the strengths of the city's source water system management and the long range importance of the SWMP.

There were four overarching questions that the CSG suggested should be addressed through pursuit of projects and programs resulting from recommendations in the SWMP. These broad questions encompass many more specific questions, some of which can be answered with current knowledge and some that will require pursuit of more detailed information. Information presented in the process section of this CSG report and the tasks identified in the recommendations section are organized to support the pursuit of answers to these questions:

- **Does Boulder have enough water for its municipal system?**
- **How should Boulder use its municipal water supplies?**
- **What should Boulder do to protect the watersheds supplying its water?**
- **How should Boulder prioritize water system expenditures and improvements?**

BOULDER'S WATER SUPPLY SUSTAINABILITY

The SWMP will provide enough information to answer some of the questions below such that a specific action can be recommended. For other questions that do not have consensus on an answer, the SWMP will supply the information necessary to support debate. For remaining questions, the SWMP will define a road map for obtaining answers during the next 20 years.

Does Boulder have enough water for its municipal system? What factors might alter the current projection that Boulder has sufficient water to meet build-out needs? What level of reliability is acceptable at build out? How should population and employment factors be accounted for in projecting adequacy of water supply? How might climate change affect Boulder's water supply and the quality of life it supports? What sources should be pursued if additional water is required? Is it strategic to buy new supplies now before knowing if events may require it, or should we focus on other priorities?

How should Boulder use its municipal water supplies? Once municipal water needs are met, how should water be divided up between other uses (e.g., preserving natural resources/ instream flows, supporting local agriculture, landscaping, groundwater recharge, etc.?) How does climate change affect these decisions?

What should Boulder do to protect the watersheds supplying its water? What watershed management and wildfire protection measures are necessary to protect Boulder's water supply? How do we deal with water quality impacts such as those associated with Nederland's waste water treatment system? What measures are required to sustain the supply treated at the Boulder Reservoir Water Treatment Facility?

How should Boulder prioritize water system expenditures and improvements? Are the benefits of the Carter Lake Pipeline enough to make it a priority compared to other projects? What improvements are needed to maintain the Barker System facilities? How do we maintain reliability of the watershed dams? Should storage enhancement opportunities be pursued?

The CSG was not a consensus-reaching group, and therefore, not all CSG members agree with each of the comments and suggestions presented in this report, nor on the need to address some issues. Please refer to the meeting summaries contained in Appendix B for a more detailed accounting of the range of opinions concerning any specific issue.

RECOMMENDATIONS

The SWMP Team (city staff and consultants) presented a preliminary list of recommendations to the CSG members in Table 1 below. One recommendation, highlighted in italics in the table, received mixed reaction from the CSG members. Several studies and actions were identified that the CSG felt were desirable to conduct in the near-term. The near-term items, which are highlighted in bold in the table, include:

1) Update the water demand projections;
2) Update the water conservation plan as it relates to revisiting the reliability criteria;
3) Negotiate with Denver Water to secure a more reliable environmental pool at Gross Reservoir.

Please refer to Appendix B for more detailed information on the CSG's discussions.

The recommendations in Table 1 will have to abide all of the applicable regulations, ordinances and charter provisions, including those governing the Boulder Water Utility enterprise.

Table 1
Community Study Group Comments on
Boulder Source Water Master Plan
Preliminary Recommendations

Category	Issue		Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making
Does Boulder have enough water for its municipal system?				
Water Availability	Water Supply Reliability	A	Continue to monitor developments on the Colorado River Compact; if state study is inadequate or does not occur, city moves ahead with other interested parties to conduct its own study of West Slope climate change impacts and mitigation options	Supports decision-making on interim balance between West Slope and East Slope water use; informs assumptions on West Slope source reliability for evaluations of need for any additional supplies for build-out and decisions about development/purchase of such supplies
		B	Continue climate studies and related effects on Boulder's source water (quantity and quality), including new scenarios as appropriate given advances in GCM resolution. Include scenarios that evaluate the need for more reservoir storage or reservoirs at other locations.	Potential to identify thresholds of change for responding to climate-based alteration of water yields and /or water quality for input to decisions on development of new water supplies or capital improvements
		C	Complete source water emergency plan	▪ Evaluate risks to city's water system if there is a reduction in yield or quality of one of the city's water sources as a result of climate change, localized drought, compact call, wildfire, infrastructure failure or contamination event and develop a decision-making framework to determine if action should be taken to reduce these risks. ▪ Timely implementation of emergency response ▪ Define city's ability to deliver water (quality and quantity) in the event that a catastrophe disables a portion of the city's source water system

Category	Issue		Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making
				▪ Decisions on most effective disaster recovery methods for watersheds ▪ Establish costs for differing levels of risk reduction
		D	Continue efforts to protect yields of current water rights but do so in a way that preserves relationships with other entities to the extent practical.	Provides guidance to city engagement in water court proceedings. May influence decisions on capital expenditures to manage supply. May affect opportunities for future collaborative action.
	Updated water demand and supply projections	**E** **F**	**Update water demand projections based on BVCP and changes in demographic/water use projections; include updated estimates of savings from federal mandates, advances in fixture manufacture, the city's water budget program and water conservation plan** **Complete modeling to define level of reliability resulting from updated demand projections, water conservation savings and supply projections**	**Quantifies the build-out water demand associated with most recent BVCP update.** **Allows decision-making based on most recent information and supports future water system modeling efforts**
	Future changes to the water rights portfolio	G H I	Evaluate balance in reliance on East Slope and West Slope supplies (including suggestions from CSG) Determine if changing balance in reliance on existing East/West Slope supplies will cause need for new water supplies for build-out Evaluate need to acquire new water rights.	Will inform decisions on: ▪ Interruptible agricultural leases ▪ Groundwater use ▪ Acquisition of additional East Slope supplies and means of delivery to Boulder ▪ Sizing and future treatment processes of Boulder Reservoir Water Treatment Facilities ▪ Use of more CBT and Windy Gap water ▪ West Slope replacement supplies ▪ Methods to increase stream recharge ▪ Keeping Windy Gap units and firming Windy Gap ▪ Repair and enhancement of storage capacity in Boulder

Category	Issue		Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making
				Creek basin ▪ Use of Boulder's exchange rights ▪ New appropriations
How should Boulder use its municipal water supplies?				
Municipal water system use	Reliability criteria refinement	J K	Refine reliability criteria to define quantitative assumptions of indoor and outdoor water usage Ask Council if re-affirmation of current reliability criteria is desired	Will better define the effect of the reliability criteria and inform any proposed changes to the reliability criteria
	Water use and conservation planning	**L** **M**	**Update Water Use and Conservation Studies** ▪ **Perform new runs of water system model with updated demand values and climate change information** ▪ **Define level of increased reliability attained by exceeding current water conservation goals** ▪ **Continue updates of water use data and water conservation plan** ▪ **see item F above** **Explore pros/cons of long-term commitment to other uses**	**Informs decisions on water supply portfolio, municipal and non-municipal uses, and land planning decisions** **Informs water conservation policies and decisions on desirability of additional conservation measures** **Supports decision-making about trading increased municipal use reliability for non-municipal uses as a use of conservation savings above current goal level** **Bears upon the question: "What are we conserving for?"**
Instream Flows	**North and Main Boulder Creeks instream flow program with CWCB**	**O**	**Update aquatic habitat studies to assess effectiveness of current program and, if needed, evaluate options for providing enhanced habitat in sufficient detail to identify impacts, costs and benefits.**	**Will provide input to evaluation of need for and feasibility of various measures to improve habitat, including suggestions presented in CSG memo**

Category	Issue		Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making
	Middle Boulder Creek instream flow releases from Barker Reservoir	P	Monitoring of water rights calls and flow rates in creek to track water released by city from Barker to Orodell	Will provide input for calls to water commissioner to protect Barker releases in lower stream segments and decisions regarding need for formal CWCB program on Middle Boulder Creek
	South Boulder Creek instream flow program development	**Q**	**Assist Open Space in developing an approach and organizational structure to provide instream flows in South Boulder Creek and through Open Space lands in sufficient detail to identify impacts, costs and benefits. Develop cooperative relationships with local ditch companies and other water rights holders where practical.**	**Will provide input to:** • **Open Space decisions on water rights purchases for instream flow use and management of Open Space riparian lands for stream water quality protection** ▪ **Collaborating with South Boulder Creek water users on improving instream flows** ▪ **Determining the need for an expanded and/or more reliable Gross Reservoir environmental pool.**
		R	Explore options for use of Utilities assets within a comprehensive program with Open Space for improved instream flows on South Boulder Creek to a level of detail sufficient to identify impacts, costs and benefits respecting enterprise status restrictions and TABOR constraints.	Will inform decisions on: ▪ Additional uses for lined Wittemyer Pond complex ▪ Additional use of Baseline Reservoir through water releases from new pipeline to South Boulder Creek for instream flow use and exchange to Gross Reservoir ▪ Windy Gap reusable water or CBT exchange to Gross Reservoir
Hydropower	Development of additional hydropower	S	Evaluate environmentally and economically feasible hydroelectric sites within the water transmission system	Consideration of hydropower at: ▪ Barker Reservoir dam ▪ Carter Lake Pipeline discharge ▪ Other sites as may become feasible Negotiation of new power sales agreements and disposition of RECs
What should Boulder do to protect the watersheds supplying its water?				
Watershed Management/ Source Water Quality	Water quality and infrastructure protection through	T	Collaborate with other entities to prepare a community watershed wildfire protection plan	Implementation of fire risk identification and fire hazard mitigation measures as part of a comprehensive watershed protection program with Boulder County, Nederland, Eldora, USFS and others

Category	Issue		Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making
	healthy forest and land use management	U	Continue working with Nederland, Eldora ski area, Boulder County, CDOT and State and US Forest Services on Middle Boulder Creek management	Resolution of issues: ▪ WWTFs (Nederland and Eldora ski area) ▪ BMPs for stormwater ▪ Septic systems ▪ Enforcement of animal regulations ▪ Response to Nederland's potential proposal regarding boating on Barker ▪ Potential of hazardous spill or illegal dumping in Middle Boulder Creek watershed upstream of Nederland
	Wildfire contingency	V	See source water emergency plan under Water Availability	
	Source water quality to Boulder Reservoir Water Treatment Facility	W	Implement measures to improve water quality and security vulnerability along the Boulder Feeder Canal and in the Boulder Reservoir basin	▪ Improves water quality for municipal supplies taken through canal and Boulder Reservoir into Boulder Reservoir Water Treatment Facility ▪ Provides protection of downstream water users and recreation use in Boulder Reservoir regardless of whether Carter Lake pipeline is constructed
How should Boulder prioritize water system expenditures and improvements?				
Facilities Improvement & CIP	Infrastructure Maintenance/ Development	X	Continue Carter Lake Pipeline CEAP and currently approved ROW acquisition and permitting	▪ Will inform decision on if/when to build Carter Lake Pipeline
		Y	Develop a 20-year CIP with a comprehensive list of capital improvements/environmental needs and projects	▪ Optimize timing for facility improvements to provide system reliability, water quality protection, ,safety, environmental protection, and minimize impacts to water rates, including prioritizing improvements to: o Barker system o Silver Lake Watershed dams o Boulder Reservoir WTF source water quality

PROCESS

CSG discussions of each of the overarching questions of the SWMP are summarized below.

Does Boulder have enough water for its municipal system?

General questions and concerns with the city's demand projections, supply reliability and climate change planning raised by the CSG included:

- Accuracy of the build-out demand projections in light of:
  - Changes in population/jobs projections in the 2005 Update of the Boulder Valley Comprehensive Plan;
  - Defining build-out based on current zoning instead of what is reasonably likely to be built;
  - Possible increased variability in hydrology (over that reflected in the historic record) due to future climate change;
- Timing of build-out, in light of the need to incur costs today to meet future water demands;
- Magnitude of the shortfalls under the climate change scenarios studied and quantification of additional supplies needed to avoid shortfalls should they occur;
- Public acceptance of potential changes to the reliability criteria;
- Adequacy of current climate change models to account for factors specific to the city's source waters (e.g., elevation, warmer water temperatures, etc.).

BACKGROUND

Staff supplied the CSG with the following information to facilitate group discussion:

- Current water use;
- Water availability;
- Colorado River management;
- Future water demands;
- The city's water system operations and planning software model;
- Projected supply reliability;
- Potential effects of climate change.

Please refer to the Meeting Minutes for Community Study Group Meeting #2 in Appendix B for more information.

The CSG was broken into two smaller groups and asked to identify strategies the city could implement to deal with potential future shortfalls due to climate change or other factors should they occur. Not every member of the group agreed with each strategy. Strategies identified by the groups and the rationale for the suggestions were:

Table 2: Strategies for Potential Future Shortfalls

STRATEGY	RATIONALE
SUPPLY-SIDE	
Acquire agricultural water as a drought supply	Easier and less expensive than new storage (but there will be increased competition for these supplies in the future).
Develop interruptible (agricultural) supply contracts for drought use	Easier and less expensive now than they will be in the future.
Protect existing water rights	Don't pay for the problems of others.

STRATEGY	RATIONALE
Maximize use of available water rights and infrastructure (existing Boulder Creek supplies, existing CBT units and Windy Gap units)	The city is accountable for optimizing the use of existing water supplies in lieu of or in addition to asking the citizens to reduce demand.
Expand Boulder Reservoir Water Treatment Facility and use more CBT water	Boulder Reservoir WTF can use more plentiful, lower quality water. Boulder is too reliant on the upper watershed.
Evaluate ground water alternatives	Groundwater is subject to different regulations than surface water. It would require additional storage to capture return flows.
Acquire more East Slope water supplies	These will not be affected by Colorado River Compact issues.
Use technology (e.g., porous pavement, reducing storm runoff peaks) to increase stream recharge.	No need to develop new sources.
Have growth bring new supplies to meet additional demand	Growth pays its own way.
DEMAND-SIDE	
Reassess build-out demand projections	To answer questions about current demand projections and ensure accurate planning
Use the existing water budget to assess and contain demand.	The water budget program already exists and can be used to maximize conservation.
Limit growth (in population and/or jobs)	Reliability criteria can be met without asking citizens to reduce demands.
Additional conservation; moving from voluntary to mandatory conservation.	Minimizes impacts to streams from developing new supplies or storage facilities.
Achieve optimal functional condition of infrastructure (reduce system losses/leaks)	No need to develop new sources.
Cooperate with other water providers to share infrastructure, increase efficiency and optimize water exchanges	Makes the most of the existing resources.

How should Boulder use its municipal water supplies?

MUNICIPAL USES

CSG members discussed the need to be comfortable with projections of water availability for meeting municipal water system needs before considering additional permanent commitments for these supplies. Concerns were expressed that increases in conserved water might go toward supporting increased growth if the reliability criteria were not more specifically defined to establish and protect the types of water use enjoyed by current city residents.

BACKGROUND

Staff supplied the CSG with the following information to facilitate group discussion:

- Overview of current non-municipal uses, programs and policies;
- Overview of current watershed management policies and practices;
- Information concerning how the SWMP relates to the Water Quality Strategic Plan.

Please refer to the Meeting Minutes for Community Study Group Meeting #3 in Appendix B more information.

NON-MUNICIPAL WATER USES

Currently, the city supports the following non-municipal uses of the source waters that also provide its municipal water supplies:

- Instream flows;
- Hydropower generation;
- Agricultural leases;
- Recreation;
- Environmental enhancements.

CSG comments and suggestions with regard to each of the current non-municipal uses are summarized below. Not all group members agree with each comment.

Group members identified instream flow issues, why they are important and possible ways to address them as follows:

Table 3: Comments on Instream Flows

BASIN	COMMENTS AND SUGGESTIONS
Global	Sufficiently develop specific instream flow enhancement plans to the point where costs and reliability impacts can be quantified.
Main Boulder Creek	Explore the possibility of extending the protected reach below 75th Street to the county line to address significant habitat/quality concerns on the lower creek.
	Quantify the historic impact of Boulder's exchange right on Boulder Creek flows.
Middle Boulder Creek	Conduct mitigation studies and make recommendations for the 2006 Barker Pipeline break to address downstream sediment impacts.
	Conduct independent EIS studies for the Barker Boulder Canyon Hydro relicensing to evaluate flow regimes, sediment deposition and wildlife impacts from hydroelectric operations.

BASIN	COMMENTS AND SUGGESTIONS
North Boulder Creek	Treat more water at Boulder Reservoir rather than exchanging to the upper watershed and treating at Betasso so that additional instream flow can be provided for Middle and North Boulder Creeks.
	Increase minimum flows in North Boulder Creek to improve aquatic habitat. Rehabilitation of Green Lake #2 Dam could provide water for additional instream flows.
South Boulder Creek	Provide more instream flows to South Boulder Creek to improve fish habitat and aesthetics by purchasing water rights for instream flows.
	Line Wittemyer Ponds to increase municipal storage and exchange opportunities and for improved instream flows.
	Construct a return path pipeline from Baseline Reservoir to South Boulder Creek to improve instream flows between Baseline Reservoir and the confluence with Boulder Creek.
	Stop suing FRICO so that FRICO will be more willing to work with the city on South Boulder Creek flows.
	Pursue Gross Reservoir environmental pool management and strategic plan development through Denver Water's ongoing EIS for expansion of Gross Reservoir to provide increased municipal and exchange opportunities for improved instream flows.
	Be involved in discussions with Denver Water to possibly restructure how water is delivered through Gross Reservoir.

CSG comments and suggestions concerning hydropower were:

- Add hydropower generation to Barker to generate clean energy;
- Generate hydropower if the Carter Lake Pipeline is constructed;
- Funding and rate impacts of hydropower generation projects need to be considered;
- Longer payback periods are acceptable for Water Utility investments in hydropower facilities as long as payback occurs over the project life.

The question was raised as to whether or not hydropower is still cost-effective compared to other alternative energy sources.

CSG suggestions concerning recreational use of source waters were:

- Develop a carrying capacity for recreation at Boulder Reservoir to manage impacts to water quality. Have reasoned justifications if and when recreational use needs to be curtailed.
- Allowing non-motorized recreation on Barker Reservoir could improve cooperation with Nederland on other issues.

CSG comments concerning use of municipal water supplies for irrigated agriculture were:

- Make preservation of agricultural ditches within the city a priority due to their riparian, storm water and other benefits and because they facilitate use of raw versus treated water for irrigation.
- Trans-basin diversions should be minimized as part of the comprehensive plan and watershed policies.

CSG suggestions for environmental enhancements were:

- Dedicate CIP funding to retrofit diversions for fish passage and other habitat improvements above Barker Reservoir.
- With regard to channel maintenance flows below Barker Dam, are channel defining flows important in maintaining flood conveyance capacity, and are minimum flows sufficient to remove traction gravel from fish habitat?
- Nederland's effluent should be treated at the point of discharge to Barker Reservoir to avoid need for additional treatment capability at Betasso Water Treatment Facility.
- Erosion control is needed on the Barker Gravity Pipeline.
- Remove or reconstruct diversion structures on South Boulder Creek to provide fish passage.
- Wildlife habitat management is needed to protect from non-native infestations, maintain riparian zones, and minimize bank erosion through restricting grazing access.
- The city should participate in the Middle Boulder Creek Rogers Park Habitat Improvement Project with the Boulder Flycasters through in-kind and CIP appropriations.
- Watershed plans are needed for non-source water drainages within our watershed, such as Goose Creek, Bear Creek, etc.
- Trans-basin diversions should be minimized as part of the comprehensive plan and watershed policies.

CSG comments and concerns regarding prioritization of non-municipal water uses were:

- Can/should the city commit to new uses (municipal or non-municipal) based on current knowledge and assumptions, or should it refrain because there will always be uncertainty in forecasts?
- Customer buy-in on the reliability criteria is needed.
- Can the resource be used more carefully to increase reliability?
- The city's legal obligations to provide water for non-municipal uses are the top priority.
- It is important that future commitments to non-municipal uses be flexible (such as allowing for instream flow pull-back in drought years).to assure municipal needs can be reliably met.
- Non-municipal uses should be prioritized according to what citizens expect Boulder to provide and the water features that people see as a reason to live in Boulder.

What should Boulder do to protect the watersheds supplying its water?

The city's broad watershed management objectives are water quality protection, facility protection and environmental and habitat protection. Management policies and practices differ by basin to address specific conditions and risks to water quality.

CSG comments and suggestions concerning watershed management are summarized below:

Staff supplied the CSG with the following information to facilitate group discussion:

- Overview of current watershed management policies and practices;
- Information concerning how the SWMP relates to the Water Quality Strategic Plan.

Please refer to the Meeting Minutes for Community Study Group Meeting #3 in Appendix B more information

Table 4: Watershed Management Comments and Suggestions

BASIN	COMMENT/SUGGESTION
All Basins	Develop a plan for shutting off intakes/diversions in case of wildfire.
	Develop a plan for pine bark beetle infestation to protect the water supply, because fire breaks won't be sufficient if all of the trees are dead.
	Evaluate the adequacy of its water supplies if one source is out of commission due to wildfire.
	Monitor long-term nitrogen deposition in alpine lakes.
North Boulder Creek	Keep the Silver Lake Watershed closed to public access to protect the quality of the water supply and the wilderness aspects of the watershed.
	Look into whether the management of North Boulder Creek should change in light of the changed status of the greenback cutthroat trout.
Middle Boulder Creek	Protect the quality and quantity of water supplies by addressing forest health through fire hazard mitigation.
	Work with Nederland to implement non-motorized boating on Barker Reservoir, because the cost and risks are low, the benefits are large, and it creates good will with Nederland in terms of addressing other, larger problems.
	Continued cooperation with Nederland is needed to minimize impacts from all sources of pollution.
	Address Nederland's wastewater treatment plant effluent discharge to Barker Reservoir to prevent having to construct more costly treatment alternatives at Betasso Water Treatment Facility. Possible methods of accomplishing this are "twisting Nederland's arms," city funding of a solution, trading boating on Barker for a discharge solution, piping the discharge around the

BASIN	COMMENT/SUGGESTION
	reservoir for discharge below Barker Dam or requiring Nederland and Boulder County to pay for the city's additional treatment requirements.
	Determine the number of potentially exempted domestic wells and whether this could cause significant depletions to water quantity.
	Kossler Reservoir is the weakest link and highest risk in Boulder's raw water supply system because of easy access/ trespass and no dilution before the water enters Betasso Water Treatment Facility.
	Monitor Eldora Ski Area discharges.
	Has Boulder County decided to ban cyanide heap leach gold mining to protect water quality (as Summit County has)?
Boulder Reservoir / Boulder Feeder Canal	Make stormwater bypass of high risk discharge areas to the Boulder Feeder Canal a priority to manage risks to the water supply.
	Install turbidity monitors under bridges along the Boulder Feeder Canal to provide pretreatment warning of turbidity spikes.
	Limit dog and horse use of the Boulder Feeder Canal corridor to protect water quality and decrease treatment costs.
	Provide support for the completion of the Boulder Feeder Canal trail.
	Examine the justification for the Carter Lake Pipeline in light of its high cost and questionable benefits.
	Cooperate with other users to fund completion of the Carter Lake Pipeline to address contamination issues and provide operational flexibility.
	Clarify cost estimates for the Carter Like Pipeline and cost-sharing among communities receiving water from the Boulder Feeder Canal.
	Assess the adequacy of the number of water quality monitoring stations to assure sufficient warning of a pollution incident.
South Boulder Creek	Cooperate with Eldorado Springs Water and Sewer District to protect Boulder's open space and the South Boulder Creek watershed.
	Immediately establish a water quality monitoring program to measure effects of pesticide and herbicide use, livestock grazing, riparian buffer zones and enforcement of open space visitor regulations.
	Implement measures to decrease water quality impacts from stormwater runoff (e.g., landscaping changes to mitigate parking lot runoff).
West Slope Watersheds	Develop a West Slope protection plan in cooperation with NCWCD and other CBT users to create a more comprehensive source water protection plan, define responsibilities, provide for

BASIN	COMMENT/SUGGESTION
	cooperative response to problems and develop a broad funding base for addressing issues.
	Monitor forest management of beetle-kill on the West Slope to learn from their experience in preparation for East Slope infestation.

The SWMP is being developed concurrently with and parallel to the Water Quality Strategic Plan (WQSP) in preparation by the Water Quality and Environmental Services Group. There is some overlap between the two plans because the SWMP is focused on all aspects of municipal source water, and the WQSP looks at all of the broader aspects of water quality issues throughout the city.

Because there is overlap between the SWMP and WQSP, the CSG identified issues and actions which are pertinent to the WQSP. CSG suggestions for issues to address in the WQSP were:

- Septic systems and land use in North Boulder Creek and Middle Boulder Creek watersheds
- Impacts to water quality from and treatment of runoff from wildfire or beetle kill areas
- Stormwater runoff improvement through a commercial landscaping ordinance
- Nederland's wastewater effluent discharge and water quality improvement at Barker Reservoir
- Continued cooperation with Nederland and others to control residential and urban runoff through use of best management practices
- Provide financial and other support to Nederland in upgrading its wastewater treatment plant
- Include a cross reference in the Source Water Master Plan and Water Quality Strategic Plan to identify common issues

How should Boulder prioritize water system expenditures and improvements?

The CSG suggested that Capital Improvement Program (CIP) project costs and timing be considered with regard to other capital improvement needs and the effects on water rates. Also, the city's debt load could be examined to determine if delaying a project would reduce necessary rate increases. In addition to the line item costs shown for projects in the CIP, additional cost detail and project timing information would be helpful. It is important that the city maintain its existing infrastructure. The CSG suggested that cost and timeline estimates be developed for

BACKGROUND

Staff supplied the CSG with the following information to facilitate group discussion:

- Overview of factors considered in determining the overall CIP and funding priorities;
- Summary of CIP funding for source water projects for 2008-2013.

Please refer to the Meeting Minutes for Community Study Group Meeting #3 in Appendix B for more information.

recommended studies and non-municipal use options so that the merits and trade-offs of those options can be evaluated along with more traditional CIP elements.

CSG comments regarding specific projects in the current CIP are summarized below:

Table 5: Comments on Current CIP Projects

PROJECT/ISSUE	COMMENT/QUESTION
Carter Lake Pipeline	The purposes of and needs for this project need to be fully explained.
	Will the pipeline be in the Boulder Feeder Canal? (Answered: No, most will follow the alignment of the existing pipeline to Broomfield.)
	If the pipeline is built, will there be any water in the canal? (Answered: The portion of Boulder's water that will be exchanged to Barker Reservoir and other people's CBT water will still be carried in the canal.)
	Has the Boulder Feeder Canal trail been approved? (Answered: Yes.)
	Will completion of the Carter Lake Pipeline require a rate increase?
	Boulder is not alone in this project. Left Hand needs the pipeline to have a reliable water supply.
Boulder Canyon Hydro	Why is relicensing so expensive? (Answered: It requires following a very specific process set out by FERC. This will include compiling much information and holding public meetings. A lot of the money is for working with the USFS to get a new land use authorization for the Barker Gravity Line.)
	A break-out and justification of relicensing costs is needed to accept that it will cost $2.8 million. Can this be justified if Boulder Canyon Hydro generates only $200,000 per year in revenue? (Answered: The license covers all of the Barker facilities. A primary purpose of doing an exemption instead of a re-licensing is to redefine the project boundaries to separate the primarily water supply facilities from the hydro facilities for future federal regulation.)
	What is the city doing with its Renewable Energy Credits? (Answered: This is the subject of a settlement agreement between the city and Xcel.)

CONCLUSIONS

At the final meeting of the CSG, the group was asked to identify the strengths in the city's current source water management and raw water system operations. CSG comments on the strengths the city can build upon with regard to its source water supplies and raw water system were:

- The city has accumulated much valuable information on water availability.through its modeling of the water system.
- The city does a good job of managing its municipal water resources.
- The city does a good job of protecting the Silver Lake Watershed.
- In addition to good management on the supply side, the city has good water demand management through its water budgets and conservation plan.
- The city is proactive on climate change.
- The city has done a good job of working to rebuild its old infrastructure.
- The city has persisted in maintaining its existing easement from the US Forest Service for Lakewood Pipeline
- The city does a good job of aggressively defending its water rights portfolio.

In addition, group members were asked for their opinions on what the Source Water Master Plan would be known for in the future. Comments were:

- For addressing the questions, "Does Boulder have enough water?" and "What do we do with it?"
- For the incorporation of the climate change issue into our thinking about water supply.
- For helping the city better evaluate issues of growth control.
- For being the first comprehensive planning document to deal with some of these issues.
- For cementing the city of Boulder's commitment to multiple uses of its municipal water supplies that was first expressed in the 1988 Raw Water Master Plan..
- For providing better input to planning decisions concerning water impacts.
- For significantly advancing the ball in this era of sustainability.
- For providing a good plan for managing and maintaining raw water system facilities.
- For addressing sustainability and City Council goals.

Attachments: Appendix A: Group Roster and Charter
Appendix B: Meeting Records

APPENDIX A

GROUP ROSTER AND CHARTER

SOURCE WATER MASTER PLAN COMMUNITY STUDY GROUP ROSTER

Name	Interest Group	Email
Bart Miller	Western Resource Advocates & WRAB	bmiller@westernresources.org
Jeff Drager or Ester Vincent	NCWCD	jdrager@ncwcd.org;evincent@ncwcd.org
Catherine Gates	Silver Lake Ditch	catherine@longsgardens.com
Alan Boles	Plan Boulder County	aebolesjr@yahoo.com
Jeannette Hillery	League of Woman Voters	jmhillery915@comcast.net
Kirk Cunningham	Sierra Club	kmcunnin@juno.com
Larry Quilling	Trout Unlimited	lquilling@comcast.net
James McConnell	Dept. of Commerce Federal Labs	james.mcconnell@nist.gov
Chuck Howe	Citizen	charles.howe@colorado.edu
Steve Pomerance	Citizen	stevepom335@comcast.net
Peter Gowen	Citizen	pjgowen@comcast.net
Sasha Charney	Boulder County Parks and Open Space	scharney@co.boulder.co.us
Sheila Murphy	Boulder Creek Watershed Initiative	sfmurphy@usgs.gov
Cal Youngberg	Citizen	cal.youngberg@ci.longmont.co.us
John Pavlovic	IBM	pavlovic@us.ibm.com
Robin Byers	WRAB	robinbyers@aol.com
Kelly DiNatale	WRAB	dinatalekn@cdm.com
Ken Wilson	City Council	wilsonk@bouldercolorado.gov
Matt Appelbaum	City Council	appelbaumm@bouldercolorado.gov

Source Water Master Plan Team:
Ned Williams, Asst. Director of Public Works for Utilities
Bob Harberg, Utilities Projects Coordinator
Carol Ellinghouse, Water Resources Coordinator
Joe Taddeucci, Utilities Project Manager
Kim Elkins, Water Resources Specialist
Bret Linenfelser, Water Quality Coordinator
Craig Skeie, Water Source Manager

Consultants:
AMEC (Lee Rozaklis)
Catalyst Consulting (Barbara Lewis, Jenny McCurdy)
Kris Kranzush
MWH (Kevin Clark, Chip Paulson, Tracy Kosloff)

Boulder Source Water Master Plan
Community Study Group Charter

This charter is intended to help clarify the role and process for the Community Study Group. In developing this draft Charter, the facilitators incorporated ideas from individual interviews with potential group members completed prior to our first group meeting. Group members were asked for suggestions on how to make the group's meetings and work most productive. This draft charter will be reviewed and refined at the first meeting of the Community Study Group to produce a final charter.

1) Purpose and Scope

The purpose of the Source Water Master Plan (SWMP) is to support the city's management of its source waters and infrastructure such that the city has a sustainable, reliable supply capable of meeting the city's present and future water supply needs. The SWMP will provide guidance to assure the city's water supply needs are met through drought periods without violating the city's adopted reliability criteria. The master plan will also provide guidance on maintaining and replacing raw water facilities so that source water deliveries are dependable. Finally, the master plan will recognize and be compatible with other city master plans and strategic plans.

The SWMP will provide a snapshot of existing conditions and provide a general roadmap for future source water studies and source water system improvements. The SWMP will focus on the following objectives:

- Compile descriptive and background information for the assets and resources which comprise the city's source water system;
- Review and update water use statistics and water rights yields;
- Document policies which affect source water system development, use and management;
- Define current and emerging issues pertaining to the city's source water assets, facilities and resources;
- Review current operations and maintenance practices;
- Develop recommendations for future studies and improvements, and;
- Provide general budgeting information and project prioritization to guide development of the ten-year Capital Improvement Plan

2) Deliverables

With the assistance of the project team, the Boulder Source Water Master Plan Community Study Group (CSG) will develop a memorandum describing issues identified by the CSG related to the city's source water system and suggested actions for addressing those issues. The memorandum will also list priorities identified by the CSG. City staff will present this memorandum to the Water Resources Advisory Board, the Planning Board and the City Council.

3) SWMP Study Process

Through a series of regular meetings, the CSG will provide advice and input to the project team regarding the SWMP:

1. What are the most important issues from CSG members' perspectives?
2. What other items are of sufficient concern to include on a longer list of issues to be addressed?
3. What are the group's ideas on how to address the issues?
4. From a community perspective and given information on the implications of the ideas suggested by the group, what are the most important ideas to act on through the SWMP and what actions should be taken?

To facilitate discussion of these questions, the project team will prepare and distribute relevant supporting information prior to each CSG meeting. Information and previous meeting minutes will be compiled and distributed at least 1 week in advance of the next meeting. To provide the information needed while avoiding information overload, background information will be posted on the SWMP website. In this way, the information will also be available to other interested individuals or organizations.

4) Roles and Responsibilities

The Community Study Group (CSG) is the working group of invited stakeholders representing a wide range of opinions and interests in the community. CSG members will meet to develop a list of issues to be considered by the project team for inclusion in the SWMP. CSG will identify their priorities for suggested actions to be taken as part of the SWMP.

The Water Resources Advisory Board reviews and provides comment on annual utilities budgets, Capital Improvement Programs, Community and Environmental Assessment Process reports for specific utilities projects, utilities master plans and utilities strategic plans and advises City Council, Planning Board and staff. The WRAB is one of two advisory bodies that will submit comments and recommendations on the SWMP for consideration by City Council.

The Planning Board reviews and provides comment on annual department budgets, Capital Improvement Programs, Community and Environmental Assessment Process reports for specific city projects, master plans and strategic plans and advises City Council and staff. The Planning Board is one of two advisory bodies that will submit comments and recommendations on the SWMP for consideration by City Council.

The Boulder City Council is the policy-setting body for the city. City staff will submit the SWMP, along with any comments or recommendations made by WRAB or the Planning Board, to City Council. The Council will accept or reject the SWMP and may make specific recommendations based on the SWMP.

Technical Consultants support the SWMP project manager in preparing the SWMP. The Consultants serve as a resource to the city SWMP Team in providing information and data to the CSG, developing white papers and presentation materials as needed to assist the CSG.

City Source Water Master Plan Team is made up of utilities department staff, including the SWMP project manager, responsible for producing the SWMP. The Master Plan Team will coordinate all work related to the SWMP, compile and review all documents, and present the SWMP to WRAB, the Planning Board, and City Council.

The City Resources Team (CRT) is an interdepartmental team chaired by the SWMP project manager, and supported by the Consultants. The Public Works, Planning, Environmental Affairs, Open Space, Fire, and Housing and Human Services Departments are represented on the CRT. The CRT supports the SWMP project manager in developing the SWMP by preparing materials related to new issue areas that are affected by or affect management of Boulder's source water supplies.

The Facilitators will support the CSG in accomplishing the tasks at hand. The Facilitators are responsible for keeping the process moving forward in an effective and productive way and are responsible for maintaining the CSG ground rules.

Other Interested Individuals will have the opportunity to learn about the plan process through the website. Meeting materials and supporting information will be posted on the website so that people can track the progress of the SWMP process. Others may also attend CSG meetings as observers. Interested individuals may submit comments via the website or through e-mail to the project manager.

5) Ground Rules

- Practice inclusive participation
- Be efficient with our time for meetings
- Be accountable for meaningful participation
- Share responsibility to achieve our purpose
- Show respect for the process and the CSG's role

APPENDIX B

MEETING SUMMARIES

The CSG met four times from October 2007 through February 2008. Meeting dates and topics are listed below:

- October 16, 2007 – Issues
- November 27, 2007 – Water Availability
- January 15, 2008 – Non-municipal Uses, Watershed Management, CIP/Facilities Assessments
- February 28, 2008 – Synthesis of Discussions

The project team prepared and distributed relevant supporting information prior to each CSG meeting to facilitate the CSG's discussions. Background information is available on the city's SWMP Web page and in an appendix to the Source Water Master Plan.

CITY OF BOULDER, DEPARTMENT OF PUBLIC WORKS – UTILITIES DIVISION
SOURCE WATER MASTER PLAN
COMMUNITY STUDY GROUP MEETING #1
Meeting Minutes

OCTOBER 16, 2007
Group Members Present: See attached roster

City Utilities Division Staff Present: Ned Williams, Bob Harberg, Carol Ellinghouse, Craig Skeie, Joe Taddeucci, Kim Elkins, Betty Solek

Consultants Present: Barbara Lewis, Jenny McCurdy, Kevin Clark, Lee Rozaklis, Kris Kranzush

Next meeting: Tuesday November 27, 2007, 4:00-6:00 p.m. East Boulder Senior Center, Panorama Room

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I. Introductions and Welcome, Ned Williams, Asst. Director of Public Works for Utilities

The Source Water Master Plan will be an update of the 1988 Raw Water Master Plan. The city is asking the group to help city staff identify issues and discuss topics which will be included in the plan. The city's source water facilities include water rights, reservoirs, water transmission facilities and treatment plants. Topics which could be sorted out in the master plan or subsequent efforts include climate change, source water contaminants, etc. The Community Study Group (CSG) process will be a several month effort. Other sources of input to the plan will be the Water Resources Advisory Board, City Council and other members of the public. The CSG will help both Utilities and the community to implement a plan to guide water resources management over the next 15-20 years.

Barb Lewis and Jenny McCurdy (Catalyst Consulting) introduced themselves. They are the CSG meeting facilitators. Members of the CSG, as well as city staff, consultants and others introduced themselves (please refer to the attached roster). Barb went over the meeting agenda.

II. Water System Overview, Carol Ellinghouse, Water Resources Coordinator and Craig Skeie, Water Resources Facility Manager

Carol presented a Powerpoint slide show giving an overview of the city's source water system. Copies of the slides are available upon request. The city's source waters include both east slope and west slope sources. At present, about 70% of the city's annual water supply is provided from east slope sources through Betasso Water Treatment Plant. About 30% is west slope water provided through Boulder Reservoir Water Treatment Plant. The city manages about 40 water rights decrees; about 9500 acres of land between the Continental Divide and the eastern Boulder County line; ten reservoirs; major raw water transmission pipelines; 8 hydroelectric power plants and; the Boulder Creek instream flow program.

Boulder's first municipal water supply diversions from Boulder Creek began in the 1880s, but the water was polluted by mine drainage from further upstream. Therefore, the city looked upstream to the Boulder Creek headwaters and Arapaho Glacier for pure water supplies. The **Silver Lake Watershed** consists of lands

acquired through Congressional grants and land purchases in the early 1900s. Dam construction in the watershed began in 1906. Lakewood and Silver Lake Pipelines were first built in 1906 and 1919, respectively.

The **Barker Reservoir System** was constructed in 1909 by a predecessor to Public Service Company. Boulder has used Barker Reservoir/Middle Boulder Creek water since 1954 and purchased the Barker system in 2001.

The **Colorado/Big Thompson Project** is operated by the Northern Colorado Water Conservancy District (NCWCD) and supplies water to all of northeast Colorado. Boulder joined NCWCD and built Boulder Reservoir in the 1950s. Boulder is the third largest holder of CBT units, after Fort Collins and Greeley.

The **Windy Gap Project** was conceived by a group of cities in northeast Colorado. Water from the Windy Gap Project is transported through CBT facilities.

Craig Skeie explained how source water decisions are made on a daily basis. His first concern in selecting which sources or water rights to use is the **call on the creek**. He makes his decisions based on daily conversations with:

- Water treatment plant staff concerning the anticipated municipal water demand;
- The Water Commissioner to determine which of the city's water rights are available for use on any given day.

The second concern in selecting water sources/rights to use is **water quality**. During certain times of year, factors such as turbidity or pH make certain waters difficult for the water treatment plant to treat. His goal is to select the highest quality water that is available on any given day.

The third concern is **hydroelectric power generation**, which is a by-product of the water system. Hydroelectric power is generated as long as it can be done within the city's water rights and while providing a high quality water supply to the citizens.

Exchange rights are exercised to fill the city's reservoirs in the spring. In April, there is no snowmelt occurring in the watershed, but the ditches with senior water rights are turned on and operating. The city's water rights are usually called out of priority before snowmelt begins. The CBT exchange can be exercised if there is a call downstream of the 75th Street Wastewater Treatment Plant and all senior users between 75th Street and the watershed can be satisfied. It takes a flow of about 200 cfs in Boulder Creek between 75th Street and Barker Reservoir to satisfy the latter users before an exchange is possible. After that, the city can release water from Boulder Reservoir to satisfy downstream senior water rights and in return, store a like amount in the watershed reservoirs. The exchange right can be exercised on either the "uphill" or the "downhill" side of peak flow.

The city has a relatively junior direct flow right on Middle Boulder Creek and can use the CBT exchange to take direct flow when that right is not in priority.

Boulder White Rock Ditch water rights are senior to the city's. The city has an agreement with the ditch company to reduce diversions at the headgate which the city then replaces with CBT water. The city can then use or store a like amount of water upstream.

The city is generally taking water from storage from July through April of the next year.

III. Source Water Master Plan Purpose and Scope, Joe Taddeucci, SWMP Project Manager

Joe gave a Powerpoint presentation on the development of the Source Water Master Plan (SWMP). Copies of the slides are available upon request. The city has implemented many of the recommendations from the 1988 Raw Water Master Plan (RWMP) including: adoption of reliability criteria; maximization of exchange rights; maintaining or increasing storage in the Silver Lake Watershed; establishing a drought storage reserve in the Boulder Creek reservoirs and; converting the Boulder Reservoir Water Treatment Plant from seasonal to year-round operation. Actions resulting from the RWMP include: sale of 43 of the city's original 80 Windy Gap Project units; use of the proceeds from that sale to purchase additional shares in ditch companies, Caribou Ranch (joint ownership with Boulder County) and the Barker System; postponement of increasing water treatment plant capacity until 2004 and; development of a drought response plan to address severe droughts or system failures. Facilities improvements since the RWMP have included: watershed dam rehabilitation; replacement of Silver Lake and Lakewood Pipelines; construction of Silver Lake and Lakewood hydro plants; continuing rehabilitation of Barker system pipelines and; reconstruction of diversion structures to allow measurement of instream flows.

The SWMP is being undertaken at the current time to respond to a number of changes since the RWMP, including: the city's better understanding of the source water system and improved modeling of its operation; the necessity of operating the Boulder Reservoir Water Treatment Plant year-round; the current water supply management and drought reserve; the purchase of the Barker system and its integration into the source water system, and; hydropower and possible future opportunities for additional hydropower. The plan is also needed to examine: the city's commitment to the instream flow program; source water protection needs; agricultural leasing policies; water system security requirements; effects of climate change on the city's water supplies and; increased concerns about wildfire and its effects on city water sources.

Tasks to be completed include: compiling information on assets and resources; updating water rights yields and use information; documenting policies; defining issues relative to assets, facilities and resources; identifying future studies and improvement project; reviewing operations and maintenance practices and; supporting budgeting priorities for the 20-year Capital Improvements Program.

The city has guidelines for preparing master plans which must be followed. The city desires its master plans to be somewhat consistent while allowing for the needs of the individual program. Certain things are outside the scope of the master planning process. For example, the master plan may recommend that the city charter or code be modified, but actually do that is not within the master planning scope.

There are two project managers for the SWMP. Joe is in charge of managing the overall efforts by staff and consultants to actually prepare the plan document. Carol is really in charge of the content of the plan.

The SWMP schedule includes: four CSG meetings between now and February 2008; three check-ins with the WRAB (November 2007-April 2008); presentation to the Planning Board (April 2008) and; presentation to the City Council (May 2008).

QUESTIONS ON THE PRESENTATIONS:

Q: Is the policy content of the 1988 RWMP assumed to remain in place or is policy under consideration?
A: Departmental policy is fair game. However, contract provisions, the City Charter, the City Code and things adopted by City Council as policy are not. (There may be recommendations that the latter be studied or modified, but modifications will not be undertaken as a part of this study.)

Q: How much influence is there from EPA and the Source Water Planning Process?
A: The Water Quality Strategic Plan will address EPA requirements. For the purposes of the SWMP, the city will assume that the water sources will be maintained at a quality which allows their continued use. The specifics methods used to maintain that quality are a part of the Water Quality Strategic Plan. The SWMP will examine current watershed management practices.

Q: You said the proceeds from the sale of Windy Gap were used to purchase Caribou Ranch with the County. Did we buy land, water or both?
A: The city and County purchased Caribou Ranch together. The city's interest is watershed protection and the Silver Lake Pipeline. The County owns most of the land, and the city has a conservation easement over it. The city owns the Silver Lake Pipeline corridor, and the County has a conservation easement over that. That was in part due to the cryptosporidium issue.

Q: Will the plan examine improving exchange yields?
A: There are limited remaining opportunities to do this, but there is some flexibility in whether we operate exchanges or not. The previous direction was to do as much as possible with exchange. However, we can perhaps look at whether or not we could fill reservoirs with junior rights on the "downhill" side of the peak flow.

Q: What is the difference between a Raw Water Master Plan and a Source Water Master Plan?
A: "Raw Water" refers to the untreated water that is delivered into the city's system. That physical supply was the focus of the RWMP. Since then, a broader, watershed perspective has been adopted. "Source water" refers to all water within a watershed, not just that which is diverted by the city.

Q: From 1988 to now, how much reliance has shifted to CBT, and what are the effects on water quality and reliability?
A: The city has grown since 1988. All future growth will be handled through the Boulder Reservoir Water Treatment Plant. We are already pushing the Boulder Creek side as much as we can. Shifting reliance to Boulder Reservoir began in the mid-1990s. We also now keep a drought reserve to ensure there is water to deliver through Betasso, and that difference is made up through Boulder Reservoir. This has increased system reliability. The 1988 plan was based on prior years, which were wet years. 1988 through 1994 were dry years, and 2000 to 2006 were drought years. During drought years the city has to rely more on CBT.

Q: In regard to the 70%/30% split between east slope and west slope supplies, how much of the 70% is from the Silver Lake Watershed and how much is from the main stem?
A: At present, 20% of that 70% delivered through Betasso Water Treatment Plant derives from the CBT exchange. At build out, it is anticipated that about 55% will be delivered through Betasso and 45% will be delivered through the Boulder Reservoir Plant. However, the water available through exchange varies from year to year.

IV. Charter Review, Barbara Lewis, Catalyst Consulting

Barb developed a charter, ground rules and process based upon group member's comments concerning past experiences with successful groups and processes. She presented a Powerpoint presentation on the CSG role in the SWMP including:

- Purpose – to provide thoughtful community input to the WRAB, Planning Board and staff on the issues and priorities for the SWMP.
- Deliverables – a memorandum to the WRAB reflecting input on commuity issues and perspective; suggestions for how to address key issues in the SWMP and feedback on draft sections of the plan.
- Four questions asked of CSG members– what issues should be addressed, which issues are most important, what are ideas for how to address these issues and what are the most important ideas to act on in the SWMP?
- CSG commitments –
    - Practice inclusive participation – by keeping open minds, listening well, allowing time for everyone to be heard, being honest, respecting each participant and their ideas and assuming there is time for public comment at each meeting.
    - Be efficient with meeting time – by sharing responsibility to keep the conversation focused and on the agenda, coming to meetings prepared, agreeing to "agree to disagree" and moving on, participating in subcommittees when needed and avoiding rehashing past meetings.
    - Be accountable for meaningful participation – by consistently attending meetings and getting up to speed if absent, communicating between meetings with the project team and among members and calling in experts if needed.
    - Share responsibility to achieve our purpose – by seeking common ground, understanding different perspectives, knowing the final decision-maker and the process and focusing on the big picture.
    - Show respect for the process and the CSG role – by maintaining the integrity of the process, accepting that City Council is the final decision-maker, presenting individual views and only documented information and avoiding characterizing the opeinions or positions of others.

The group agreed with the Charter and Ground Rules by nod.

BREAK

V. Review of Issues Identified to Date: Issue Map, Jenny McCurdy and Barbara Lewis, Catalyst Consulting

Barb mentioned that two group members – Larry Quilling and Cal Youngberg are absent today. In addition, Kelly DiNatale of the WRAB will be joining the group but

was unable to attend this meeting. There may also be a member of City Council attending future meetings.

Group members have been provided with a comment sheet if they wish to write out questions, suggestions or issues.

Jenny presented the *City of Boulder Source Water Issues of Concern* map provided to the members. Issues were identified from interviews with the study group members and also by city staff. These were grouped into common themes designated by the letters on the map. Some of the letters are tied to a geographic area and some are system-wide.

The comment was made that the reliability issue appears to be restricted to just the CBT component of the system, but we should be considering the reliability of the other sources, too.

QUESTIONS

Q. The water use issues are all tied to the demand side. Don't we also need to treat the supply side?
A. We look at demands on the source waters and realize there are different ways to meet them. Municipal demands and how they are affected by the conservation goals is one type of demand. Our focus is how we balance the various different demands with the supplies.

Q. The reliability criteria and issues about them are the target of the master plan. The reliability criteria have no definitions in terms of how much use they represent. We can say that outdoor use will be cut in one of 20 years, but what real output is the city guaranteeing? What do these scenarios mean in light of climate change? What is the city guaranteeing residents and businesses in terms of water supply for the future? Are the numbers set in the water budget targets for the indefinite future, or will the numbers get cranked down to increase the supply available for future development? For the reliability criteria to be meaningful, they must be defined in absolute terms with respect to types landscaping to be supplied for outdoor uses and specific per capita end use deliveries for indoor uses.
A. This process is for general planning and to bring together all existing data so we can examine it comprehensively. It's to provide a current snapshot of the system. The specification of a number of gallons per square feet is in other processes, for example, the water budget/rate process. The SWMP will point out if there is a concern and may recommend that we need to study it.

Q. In the RWMP, the reliability criteria were used to evaluate the system. The probabilities assumed are no longer valid because the future will not be the past. We need to know, "What's the output?" Are we meeting the target and if yes, what's the target? Both quantity and probability need to be examined. The ability of the City to meet the reliability standards should be based on reasonable, worst-case forecasted conditions, not historical conditions, which are likely to be much better than what we can expect in the future. The reliability criteria may not need to be changed, but they do need absolute definition given the water budget structure.
A. The intent is to bring together and compile all we know now on these issues. The RWMP laid out the reliability criteria, and the City Council voted to adopt them. Since then, our efforts, for example the Drought Plan, have been based on the criteria. Now, we need to look at what we have done. What does it say we need to

do next? The SWMP will identify what we need to do next, but it will not do it. It is intended to get a picture of what needs to be done, so that a roadmap showing how we get there can be developed. The plan may result in a recommendation that the reliability criteria need to be defined in terms of actual numbers in order to be meaningful.

Each group member was asked to briefly identify which issues they see as most important and why:

Bart Miller – the conservation piece, which may involve reliability criteria; embedding the conservation goals in the supply plan; instream flow issues.

Ned Williams- the adequacy of the supply for future needs; the role of other departments, such as Parks and Recreation and Open Space and Mountain Parks.

Sasha Charney – collaborative planning with other entities in the area; examining their portfolios and working together to achieve objectives; agricultural use.

Jim McConnell – reliability of supply; NIST is one of the largest water users in Boulder, and we need plenty of water at constant pressure to function.

Nichole Seltzer – water quality standards compliance; compliance of the streams; protecting CBT and Windy Gap yields and however Boulder can help NCWCD in this regard; general source water quality protection for the Fraser River and the 3 lakes; Carter Lake Pipeline.

Robin Byers – WRAB should probably not advocate; there is not adequate representation of the private sector in this group.

Chuck Howe – collaborative planning; the relationship to CBT regarding large and costly projects for Boulder.

Catherine Gates – other providers; irrigation ditches as providers to the citizens and the land; collaborative planning to allow working together and not promote competition for sources.

John Pavlovic – reliability for the future in terms of running the IBM facility; competition for water resources; how does IBM's irrigation with ditch water play in the big picture?

Steve Pomerance – reliability criteria (previously discussed); that this process will lead to results, but action won't be taken at the required velocity, thereby preventing the city from being proactive in terms of doing what is needed while you still can.

Sheila Murphy – watershed management issues; instream flows in South and Middle Boulder Creeks; water conservation.

Alan Boles – what are we conserving water for? Is it to support growth, or is there a greater purpose; how we came up with the demand projections; reliability.

Kirk Cunningham – defoliation and forest die-back; definition of build out (is it consistent among city agencies?).

Peter Gowen – reliability to meet future demands of the city; optimally efficient operation and utilization of the system; optimal external efficiency (while Boulder is at the top of the watershed, there may still be some opportunities for cooperation with other providers).

Jeannette Hillery – (also President of the Howard Ditch); understanding of ditches and what they are; wildfire and water quality in terms of impacts to the water system; facility control system upgrades to ensure the system keeps going; collaboration.

Bob Harberg – confirming the priority of Capital Improvements Program projects; Carter Lake Pipeline and confirming that this alternative would result in the biggest positive effect.

Carol Ellinghouse – taking a comprehensive look at where we are and what we are doing; we are at the end of what we can tack onto the old framework and need a new framework.

Joe Taddeucci – operations and maintenance; making sure we are taking care of our facilities in an organized and timely fashion.

From the "audience:"

Kim Elkins – has no issues.

Lee Rozaklis – there are trade-offs between reliability and uses, and we make choices in this regard. Information is needed to revisit the available choices, what the trade-offs are and are we happy with the mix?

Craig Skeie – has no issues.

Betty Solek – is the Project Manager for the Water Quality Strategic Plan and is interested in hearing about water quality issues.

Kris Kranzush – as a resident, interested in reliability; also wildland fire, which can rapidly have major, significant effects on the source water system.

Jim Knopf – issues shared with Lee and Bart; the water budget needs to work really well; what is conserved water used for?

Dan Johnson – concerned as citizen; also infrastructure maintenance and hardware prioritization.

Barb summarized the new issues identified in the meeting. (See attached "map" of "sticky board"). She asked the CSG to pick the four most important issues and mark them on the sticky board with the dots provided as the members leave. The data from this exercise will be summarized and distributed before the next meeting. This is only intended to give staff an indication of the relative importance of the issues to the group.

Reading materials – draft information concerning existing data and facilities – will be sent to the CSG a couple of weeks before the next meeting, November 27.

Meeting Evaluation –

Pluses: staying on time; the meeting was fast; snacks; attendance and participation.

Minuses: wish there had been more time for discussion; hope decision pieces have adequate time.

"Snapshot" of sticky board:

RELATED STUDIES

Water Quality Strategic Plan

-water quality standards compliance

Open Space and Recreation were not envisioned as covered

Issues Map – 10/16/07

New Issues:

Collaborative water rights planning

Collaborative planning/see opportunities across portfolios

Internal/external efficiencies of water operations

What do we do with water that is conserved?

Confirm priority of CIP projects, including Carter Lake Pipeline

What is the city guaranteeing residents/businesses in the future?

Deforestation/die-back

Reliability beyond CBT (make it broader)

Revisit mix of choices

PARKING LOT

Definition of build out – is it consistent across city agencies?

CSG Issues Prioritization

10/16/07 CSG Meeting

Category	Issue	Dots	Dots in Category
A. Water Availability			
	Adequacy of supply for future needs	4	15
	Reliability Criteria:	4	
	Current water right yields	2	
	Reliability of CBT	2	
	Possible effects of climate change	1	
	Collaborative water rights planning	1	
	Reliability beyond CBT	1	
	Need for new reservoir storage and/or rights		
	Protection of existing water rights		
B. Watershed Management			
	Wild land fire risk management	2	6
	Overall category of watershed management	1	
	CBT west slope source watersheds	1	
	Integration of land water quality & water yield protection	1	
	Recreational water quality impacts	1	
	North Boulder Creek & Caribou Ranch		
	Barker Reservoir (Nederland wastewater, stormwater, septic)		
	CBT east slope source watersheds		
	Invasive Species		
	Deforestation/dieback		
C. Streamflows			6
	South Boulder Creek habitat flows	3	
	North & Boulder Creek programs	1	
	Middle Boulder Creek program	1	
	Gross enlargement & instream flow storage	1	
	Recreational water flows		

Note: Priority issues identified from the dots exercise are shown at the top of the list in each category. Blue italicized issues are new issues identified at the 10/16 CSG Meeting

CSG Issues Prioritization

10/16/07 CSG Meeting

Category	Issue	Dots	Dots in Category
D. Infrastructure Maintenance & Improvements			6
	Confirm priority of capital improvement program projects including the Carter Lake Pipeline	2	
	Overall Category of Infrastructure & maintenance Improvements	1	
	Raw Water system Capital Improvement Program	1	
	Carter Lake Pipeline	1	
	Green Lake no. 2 reconstruction	1	
	Internal efficiency of water operations and also external/cooperative efficiency		
	Barker Gravity Pipeline		
	Albion system rehabilitiation & replacement schedulilng		
	Lakewood Pipeline monitoring		
E. Security & monitoring		1	1
	Raw water facilties security systems		
	Facilities constrol systems upgrades		
F. Conservation & Drought Response			9
	Accuracy of demand projections	4	
	Priority of uses served in drought	2	
	Adequacy of Drought Plan	1	
	What is the city guaranteeing residents in the future?	1	
	Modification of existing integration of demand management planning	1	
	Modification of demand projection methods		
G. Water Use Values			9
	What do we do with the water conserved	3	
	Hydroelectric power generation	2	
	Collaborative planning: opportunities across portfolios/agricultural use - esp. w/ NWCCD	1	
	Revisit the mix of choices	1	
	Irrigation ditch contributions	1	
	Balancing municipal agricultural & environmental water needs	1	
	Recreation (Boulder Feeder Canal, Boulder & Barker Reservoirs, Boulder Creek		
	Water utility support of non-municipal water uses (ag. leasing, instream flow, hydro)		
	Open space and recreation not envisioned as covered		
	Total Dots	52	

Note: Priority issues identified from the dots exercise are shown at the top of the list in each category. Blue italicized issues are new issues identified at the 10/16 CSG Meeting

Roster of Participants:

	Name	Interest Group	Phone	Email
✓	Bart Miller	Western Resource Advocates	303-444-1188 x 219	bmiller@westernresources.org
✓	Nicole Seltzer	NCWCD	970-622-2277	nseltzer@ncwcd.org
✓	Catherine Gates	Silver Lake Ditch	303-442-4801	catherine@longsgardens.com
✓	Alan Boles	Plan Boulder County	303-447-3280	aebolesjr@yahoo.com
✓	Jeannette Hillery	League of Woman Voters	303-494-7718 (h)	jmhillery915@comcast.net
✓	Kirk Cunningham	Sierra Club	303-939-8519 303-442-2335	kmcunnin@juno.com
	Larry Quilling	Trout Unlimited	303-543-0939	larry_quilling@maxtor.com
✓	James McConnell	Dept. of Commerce Federal Labs	303-497-5660	james.mcconnell@nist.gov
✓	Chuck Howe	Citizen	720-562-8089(h) 303-492-7245(o)	charles.howe@colorado.edu
✓	Steve Pomerance	Citizen	303-447-8026	stevepom335@comcast.net
✓	Peter Gowen	Citizen	303-494-1536	pjgowen@comcast.net
✓	Sasha Charney	Boulder County Parks and Open Space	303-678-6200	scharney@co.boulder.co.us
✓	Sheila Murphy	Boulder creek Watershed Initiative	303-541-3023	sfmurphy@usgs.gov
	Cal Youngberg	Citizen	303-651-8399	cal.youngberg@ci.ongmont.co.us
✓	John Pavlovic	IBM	303-924-7820	pavlovic@us.ibm.com
	Judy Bigger	Boulder Tomorrow	303-449-0228	judy@bouldertomorrow.com
✓	Robin Byers	WRAB	303-440-3413	robinbyers@aol.com
	These people would like to receive emails but will not be at the meetings			
	Boyd Sheets	Farmers Ditch/North Boulder Farmers Ditch/ Boulder and Lefthand Ditch	720-220-0137	boyd49@aol.com
	Mike Cuskelly	School District	303-447-1010	mike.cuskelly@bvsd.k12.co.us
	John Tayer	Roche	303-442-1926 (o) 303-499-5444(h)	john.tayer@roche.com
	Jonathan Akins	University of Colorado	303-492-1275	Jonathan.Akins@Colorado.EDU

✓ In attendance 10/16/07

CITY OF BOULDER, DEPARTMENT OF PUBLIC WORKS – UTILITIES DIVISION
SOURCE WATER MASTER PLAN
COMMUNITY STUDY GROUP MEETING #2
Meeting Minutes

November 27, 2007
Group Members Present: See attached roster

City Utilities Division Staff Present: Ned Williams, Bob Harberg, Carol Ellinghouse, Craig Skeie, Joe Taddeucci, Kim Elkins, Bret Linensfelser

Consultants Present: Barbara Lewis, Jenny McCurdy, Tracy Kosloff, Lee Rozaklis, Kris Kranzush

Next meeting: Tuesday January 15, 2007, 4:00-6:00 p.m. East Boulder Senior Center, Panorama Room

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I. Introductions and Welcome, Ned Williams, Asst. Director of Public Works for Utilities

Ned reiterated that the Source Water Management Plan is an update with new focuses of the Raw Water Master Plan completed 20 years ago.

The City Council appointed two liaisons to this committee – Ken Wilson and Matt Applebaum. In addition, there is WRAB representation on the committee. These individuals are not speaking on the direction of their Board. Both the City Council and WRAB will have legislative functions with regard to the Source Water Management Plan next year. This group is engaging in executive type meetings under the City Manager's focus.

Jenny McCurdy went over the topics for tonight's meeting. Tonight the group will discuss water availability, infrastructure maintenance and improvement and demand, conservation and drought. The three overarching questions being asked are:

- Are supplies adequate?
- If not, what options are available?
- What input does the group want to provide concerning project prioritization in the Capital Improvement Program?

The January meeting will focus on nonmunicipal water uses and watershed management. There will also be key questions on those subjects.

The subject of collaborative planning/processes comes up in each of the discussions. The results of the discussions will be packaged and provided to lead to a memo from the group to the WRAB. That memo will be prepared during the fourth group meeting in February.

Barbara Lewis provided handouts to the group including comment forms from the first meeting and an email from Steve Pomerance concerning information on the Colorado River and CBT. Group members with information to share should get it to Joe Taddeucci. Chuck Howe commented that he has a paper to share that would be better on the city's website. Joe explained that it is difficult to put information on a

city Web site and maintain impartiality. Group members were asked to indicate on the sign-in sheet if they would like to receive Chuck's information.

Robin Byers noted that there should be a change in the meeting summary from the first meeting. She had commented that there is not adequate representation of the private sector in the group.

II. Water Availability Overview, Lee Rozaklis, Hydrosphere Resources, Inc.

Lee Rozaklis presented a Power Point presentation on water availability, including information on:

- Future water demands
- The Boulder Creek model
- Projected supply reliability
- Potential effects of climate change.

The Power Point slides are attached and will also be available on the city's project website at www.bouldercolorado.gov. Go to the Utilities page and select Source Water Master Plan from the Projects and Programs list.

III. Questions and Responses

Steve Pomerance asked if instream flow is external and fixed. Lee replied that in the model, it is a demand other than municipal demand.

Chuck Howe asked what the time frame is for build out. Carol Ellinghouse replied that a year is not specified in the Boulder Valley Comprehensive Plan for build out, but in general build out is about 30 years out. Chuck commented that costs are incurred today for future water demand.

Sasha Charney asked if the 2003 Drought Plan modeling treats each year discretely or are multi-year droughts accounted for with each year considered sequentially with reservoirs carrying over water to the next year. The longest below normal hydrology in the 300 years modeled is 14 years from 1875 to 1889.

Chuck Howe asked how the 1-in-20 criterion could fail to be met and the 1-in-100 criterion be met (for 28,600 acre-feet of demand in 2030). Lee explained that the reliability criteria are increments of demand. Minor reductions could occur every 10 or 15 years. The 100-year criterion involves restrictions so severe that permanent landscaping would be impaired.

Matt Applebaum asked how much do we miss by and how frequently. Lee explained that it is assumed that no Colorado River interstate compact calls would be made on the city's CBT supplies. (The State will begin to study this next spring). It is also assumed that there are no adaptations to current operations. It is possible that changes in operations could make some of the violations go away.

Chuck Howe asked if it is assumed that infrastructure is reliable. Lee replied that infrastructure is assumed to be reliable.

Steve Pomerance asked about the range of climate change models used. If the models are close to each other, the distinctions between them may not be

meaningful. Lee replied that the dry model is one of the worst in regard to annual precipitation. Another one has a dryer winter and wetter summer. Kelly DiNatale asked if the model is for wetter summers above 9000 feet. Lee said that the current models don't deal specifically with elevation. They are based on a 200 mile grid. The next generation of models will be based on a 20 X 20 mile grid, and they may allow elevation to be considered.

Kelly DiNatale asked if the models address water quality. Warmer temperatures would lead to greater algae growth and deposition of nutrients. Bob Harberg replied that the city assumes that water quality will be useable with treatment.

Kelly asked what happens if the model is run with the Boulder Valley Comprehensive Plan build out demands. Lee said there would probably be a significant difference, and they are trying to decide whether to do that model run.

Chuck Howe asked if CBT water is reusable. It is not. It is considered to be owed to the people downstream.

Steve Pomerance said there is a piece missing. What happens if there is increased variability? The hydrology is historic. Lee said that the numbers in the model change year to year. The numbers in the climate change model also vary from year to year.

Matt Applebaum asked if using the numbers from the Boulder Valley Comprehensive Plan would reduce the number of bad years. How much more water would it take to avoid a 1-in-1000 year situation?

Kelly DiNatale said there are two ways to deal with shortages: decreasing demand and increasing supplies. But first we need to look at whether we have a realistic projection of future water demand.

Bart Miller said that perhaps 7000 acre-feet would assure against the very worst scenario. Does the model include agricultural leases in a dry year? Lee said that the model is based on the city's use of its entire portfolio. Instream flows can be pulled back to gain 1500-2000 acre-feet of water, but it is not pulled back in the model. Carol said the city took back instream flow water in 2002, but stream flow was maintained in spite of that by downstream calls.

Sasha Charney asked how the reliability criteria were determined. Was there a survey to determine public tolerance? Would the population be tolerant of a change in the criteria? Lee and Steve Pomerance said the reliability criteria were based upon what sounded good at the time. There was community support of instream flows.

Chuck Howe said there is a 1990 study about attitudes with regard to reliability and the willingness to pay for it. Boulder is willing to pay for reliability. He will send that study out.

Steve Pomerance pointed out that nobody within the community had a clue what it would be like until 2002. Attitudes have changed. He also pointed out that build out is based on what is reasonably likely to be built, not current zoning.

Barbara Lewis divided the group into two groups to discuss suggestions to improve assessment strategy as well as to identify strategies for addressing potential shortfalls due to climate change or other factors.

IV. Table Groups on Water Availability Options

The group was divided into two small groups for discussions and then reported back to the large group. Group #1 identified:

- Protect existing water rights (don't pay for others' problems).
- Use the water budget to move to/assess/contain demand.
- Options on ground water.
- Agricultural water as a source (in drought years).
- Ground water sources.

Group #2 identified:

- Interruptible agricultural water contracts (pursue these now as they will only become more expensive in the future).
- Additional conservation (once in a shortage).
- Maximum usage of available water/optimal functional condition of infrastructure.
- Technology to increase system efficiency.
- Limit growth (population and/or jobs) so that the supply is never exceeded.
- Cooperation among providers (e.g., sharing infrastructure and optimizing water exchanges).
- Acquiring more East Slope supplies to buffer against a Colorado River call.

V. Considerations for Prioritizing Projects and Water Uses

Due to a lack of time, this discussion will be carried over to the next meeting. Group members have been provided with a comment sheet if they wish to write out questions, suggestions or issues.

VI. Wrap-Up

Meeting Evaluation –

Pluses:

- Lee did a great job.
- We got done on time.
- Face-to-face discussions are productive.
- Small group discussions are effective.
- Lee raises confidence in what the city is doing.
-

Minuses:

- Avoid asking for prioritization in group discussions (e.g., "top 3").
- A room with better acoustics is needed for small group discussions.

"Snapshot" of sticky board:

PENDING ISSUES/ACTIONS

-Put Lee's slides on the Web site.

-Distribute project list with CIP.

#3- 1/15 EBCC
#4 – 2/28 WBSC

One suggestion for Improving Boulder's Assessment of Water Availability is…….

QUESTIONS

Roster of Participants:

	Name	Interest Group	Email	Present 11/27
1	Bart Miller	Western Resource Advocates & WRAB	bmiller@westernresources.org	√
2	Nicole Seltzer	NCWCD	nseltzer@ncwcd.org	
3	Catherine Gates	Silver Lake Ditch	catherine@longsgardens.com	√
4	Alan Boles	Plan Boulder County	aebolesjr@yahoo.com	
5	Jeannette Hillery	League of Woman Voters	jmhillery915@comcast.net	√
6	Kirk Cunningham	Sierra Club	kmcunnin@juno.com	√
7	Larry Quilling	Trout Unlimited	larry_quilling@maxtor.com	
8	James McConnell	Dept. of Commerce Federal Labs	james.mcconnell@nist.gov	
9	Chuck Howe	Citizen	charles.howe@colorado.edu	√
10	Steve Pomerance	Citizen	stevepom335@comcast.net	√
11	Peter Gowen	Citizen	pjgowen@comcast.net	√
12	Sasha Charney	Boulder County Parks and Open Space	scharney@co.boulder.co.us	√
13	Sheila Murphy	Boulder creek Watershed Initiative	sfmurphy@usgs.gov	√
14	Cal Youngberg	Citizen	cal.youngberg@ci.longmont.co.us	√
15	John Pavlovic	IBM	pavlovic@us.ibm.com	
16	Robin Byers	WRAB	robinbyers@aol.com	√
17	Kelly DiNatele	WRAB	dinatalekn@cdm.com	√
18	Ken Wilson	City Council	wilsonk@bouldercolorado.gov	√
19	Matt Appelbaum	City Council	appelbaumm@bouldercolorado.gov	√

Presentation to SWMP Community Study Group

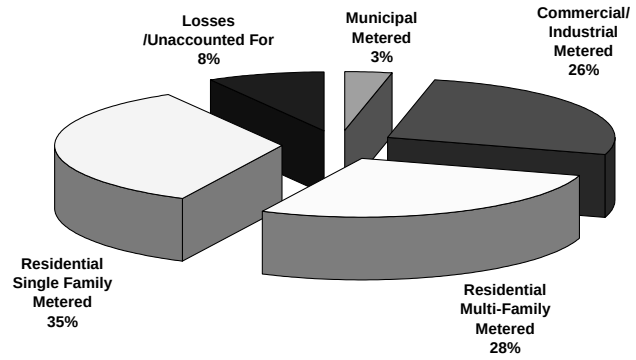
Lee Rozaklis
Hydrosphere Resource Consultants
November 27, 2007

Outline

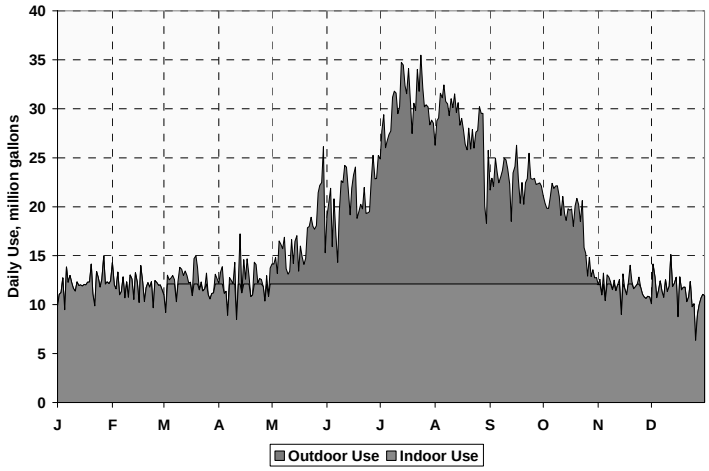
- Boulder's future water demands and how they are estimated
- How the Boulder Creek model works
- Boulder's projected water supply reliability
- Potential effects of climate change

Characteristics of Boulder's Water Demands

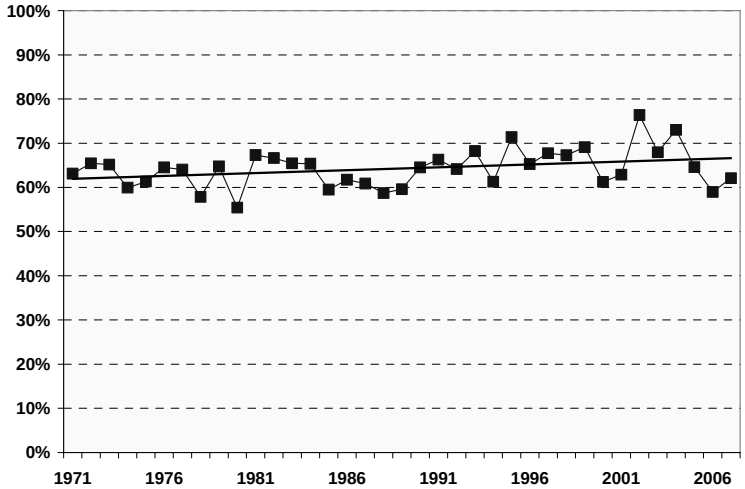
Water Demand by Customer Sector



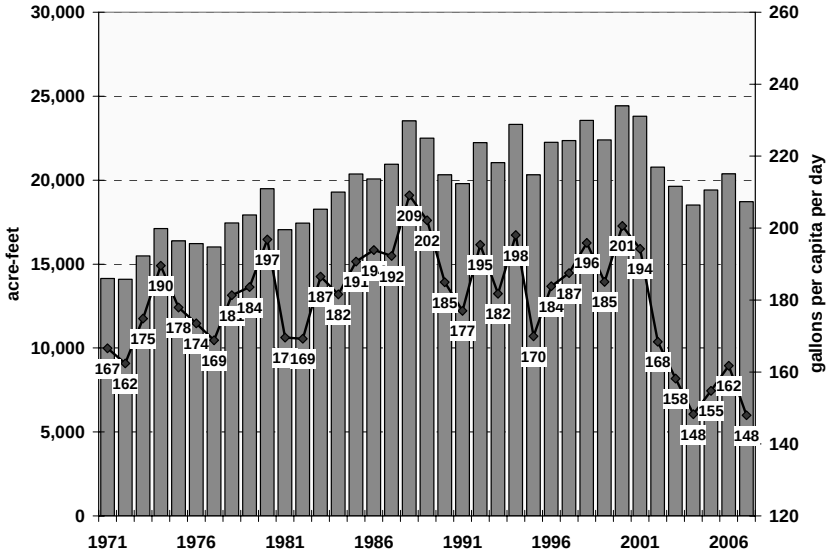
Indoor and Outdoor Uses



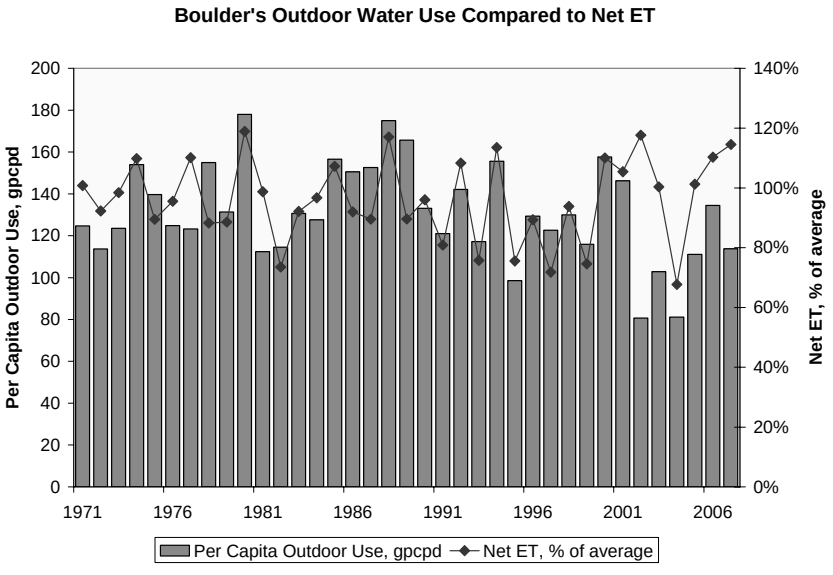
Indoor Use as a Percent of Total Use



Trends: Total and Per Capita Demands



Trends in Outdoor Uses



Factors Considered in Estimating Boulder's Future Water Demands

- Demographic factors:
  - service area population
  - service area employment
- Water use factors:
  - per capita residential use
  - per job non-residential use
  - per capita municipal use

Boulder's Build-out Water Demand Projections

- 2003 Drought Plan: based on build-out population and employment projections, and water use factors reflecting Boulder's adopted Comprehensive Water Conservation program
- 2005 BVCP Update: most recent population and employment projections—15,000 fewer residents and 7,400 more jobs than those assumed in the Drought Plan

Population and Employment Values

	2004 Actual	Drought Plan Build-out Projection (2003)	2005 BVCP Update Build-out Projection
Population	111,500	140,500	125,560
Employment	101,100	164,600	171,970
Annual Water Demand (acre-feet)	19,400 (avg. 2003-2006)	28,600	26,500 (preliminary estimate)

- Drought Plan and 2005 BVCP Update projected water demands assume water savings from Boulder's adopted Comprehensive Water Conservation Program as estimated in the Water Conservation Futures Study

The Boulder Creek Watershed Model

Assessment of Boulder's Water Supply Reliability

- Model runs done for specified water demand level
- Modeled water demands reduced in years meeting drought response triggers from Drought Plan
- Modeled drought year demands reduced according to Drought Plan water use reduction goals
- Result is determination that a particular demand level meets or fails the reliability criteria

1989 Reliability Criteria

Reliability criteria are goals for how much water must be provided during droughts

For droughts of the following severities:

- Up to 1-in-20 year severity — fully satisfy all municipal water needs
- 1-in-20 year to 1-in-100 year severity — water use restrictions except as necessary for continued viability of landscaping
- Up to 1-in-1000 year severity — ensure reliability of supply for "essential uses" (indoor domestic, commercial, industrial, fire fighting)

2003 Drought Response Plan
Drought Stages based on Reliability Criteria

No drought declaration in 19 out of 20 years on average.

For a drought severity occurring:

- 20 to 50 years on average
  Stage I – meet all municipal water needs
- 50 to 100 years on average
  Stage II – survival of landscaping
- 100 to 1,000 years on average
  Stage III – may lose landscaping
- ≤ 1,000 years
  Stage IV – meet health and safety needs

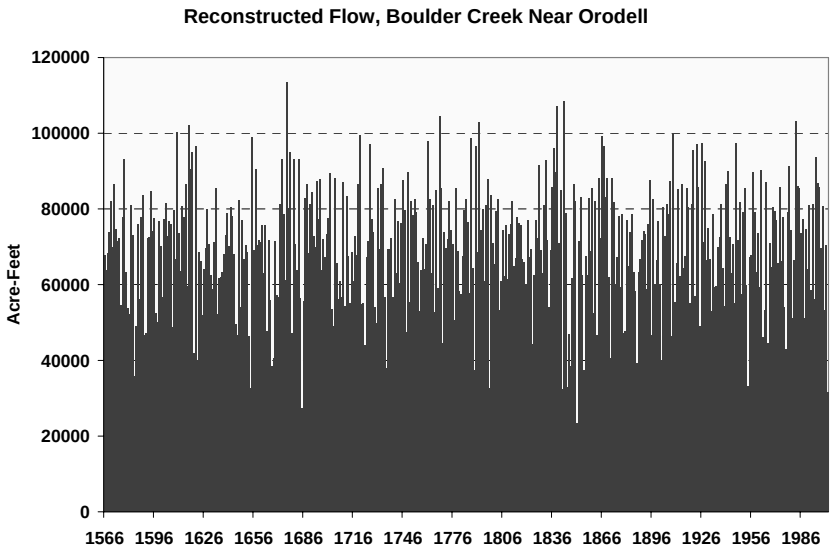
Drought Stages and Water Use Reduction Goals

Drought Alert Stage	Description	Total Annual Water Use Reduction Goal	Irrigation Season Water Use Reduction Goal
I	Moderate	8%	10%
II	Serious	14%	20%
III	Severe	22%	30%
IV	Extreme	40%	55%

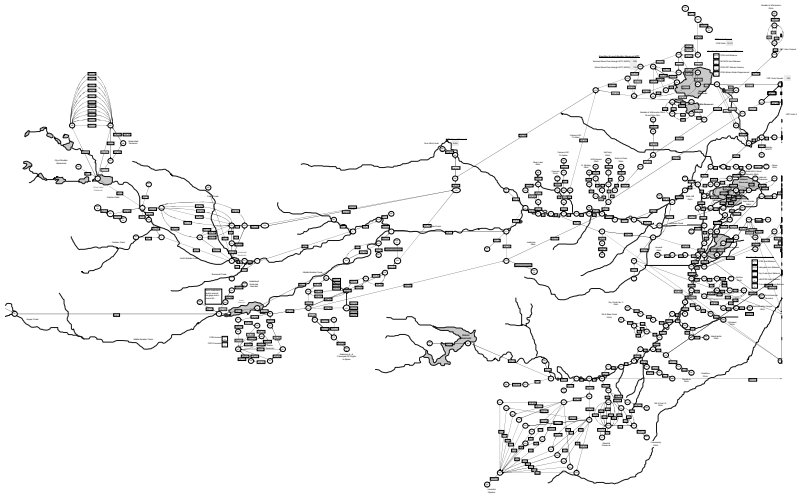
What the Model Simulates

- Streamflows, water rights, diversions, exchanges, reservoir releases, return flows
- Facilities: reservoirs, pipelines, ditches, WTPs, WWTPS
- Boulder's water supply system operations, including drought response triggers and demand reduction goals
- Ability to meet specified annual water demand up to level of reliability criteria using Boulder's existing water rights

Expanded Hydrology Based on Tree Ring Data



Boulder Creek Basin Network (partial)



Time Series Inputs: Natural Inflows

- North Boulder Creek at Silver Lake
- North Boulder Creek gains at Lakewood
- Middle Boulder Creek at Nederland
- Boulder Creek gains at Orodell
- South Boulder Creek at Gross Reservoir
- South Boulder Creek gains at Eldorado Springs
- Colorado River near Hot Sulphur Springs

Other Time Series Inputs

- Boulder Creek gains between Orodell & 75th Street
- Boulder Creek Gains between 75th Street & mouth
- CBT Imports
- Windy Gap Imports
- South Platte Calls
- Temperature and Precipitation (for ET calculations)

Results of 2003 Drought Plan Modeling

Reliability Criteria are met

Drought Alert Stage (% Use Reduction)	Annual Water Supply Amount Provided (af)	Number of Occurrences in 300 Model Years at 28,600 af Demand	Number of Occurrences Allowed by Reliability Criteria	Model Year of Occurrence
Full demand satisfied	28,600	290	285	All years but those below
Level I (Moderate (8%)	26,312	5	7	1842, 1848, 1852, 1885, 1890
Level II Serious (14%)	24,596	3	5	1851, 1887, 1889
Level III Severe (22%)	22,308	2	3	1888, 2002
Level IV Extreme (40%)	17,160	0	0	None

Potential Effects of Climate Change – What We Know (we think)

- Warmer
- Maybe drier, maybe wetter
- Earlier spring runoff
- Decreased late summer stream flows
- Increased ET (evapo-transpiration)

Matrix of Scenarios Modeled

- Three greenhouse gas emission scenarios: A2, A1B, B1 (worst, moderately bad, moderate)
- Three global circulation model types: dry, mid and wet
- Two time horizons: 2030 and 2070
- Result: 187 runs, each modeling 435 years of Boulder's water supply system operations

Potential Impacts to Water Supplies – What Might Happen (we think)

- Increased irrigation demands
- Increase or decrease in Boulder's water supply yields
  -- more or less precipitation
  -- earlier runoff could increase yield of Boulder's storage water rights
- Reliability criteria met in most scenarios
- Increase in frequency of minor drought alerts

Summary of Model Results – Reliability Criteria (assuming 28,600 acre-feet annual demand)

Emission Scenario	Model Type	Year	1-in-20 year criterion met?	1-in-100 year criterion met?	1-in-1000 year criterion met?
Drought Plan (300 years)			yes	yes	yes
BASE CASE			yes	yes	yes
B1	Wet	2030	yes	yes	yes
B1	Mid	2030	yes	yes	yes
B1	Dry	2030	**no**	yes	yes
A1B	Wet	2030	yes	yes	yes
A1B	Mid	2030	yes	yes	yes
A1B	Dry	2030	**no**	yes	yes
A2	Mid	2030	yes	yes	yes
A2	Dry	2030	**no**	yes	yes
B1	Wet	2070	yes	yes	yes
B1	Mid	2070	yes	yes	yes
B1	Dry	2070	yes	yes	yes
A1B	Wet	2070	yes	yes	yes
A1B	Mid	2070	yes	yes	yes
A1B	Dry	2070	**no**	yes	**no**
A2	Mid	2070	**no**	yes	yes
A2	Dry	2070	**no**	**no**	**no**

Note: "yes" = criteria met in each of the 11 traces

Major Assumptions

- Boulder's modeled demands are higher than recent BVCP update
  (28,600 AF v. 26,500 AF est.)
- Colorado River Compact calls met via replacement arrangements (reduced CBT/WG supplies based on climate change effects to physical supply only)
- No modeling of attempts to adapt water system operations to climate change

Summary

- 3 of 8 scenarios in 2030 would result in more minor drought water use reductions (1-in-20 year events), but no violation of the other reliability criteria
- 2 of 8 scenarios in 2070 would violate 1-in-100 or 1-in-1000 year reliability criteria

Conclusions – Planning Efforts

- Boulder is “ahead of the pack” in planning for effects of climate change on its water supply system
- Explicit modeling of climate change scenarios
- 400+ years of stream flow data
- Adopted reliability criteria
- Modeling of drought recognition and response

Conclusions - Findings

- Reliability criteria met in majority of future climate change scenarios
- Major uncertainties regarding Colorado River aspects
- Insufficient basis for immediate expenditures for climate change solutions
- Best current action is to define when information becomes “actionable”
- Consider “No regrets” actions – good now, good “if”

Future Options, if…

- Additional demand reduction measures
- Change reliability criteria to allow more years with minor water use reduction
- Transfer from agriculture (Boulder Creek?, other South Platte?, West Slope?)
- Storage options (limited)
- Reuse options (very limited)

CITY OF BOULDER, DEPARTMENT OF PUBLIC WORKS – UTILITIES DIVISION
SOURCE WATER MASTER PLAN
COMMUNITY STUDY GROUP MEETING #3
Meeting Minutes

JANUARY 15, 2008
Group Members Present: See attached roster

City Utilities Division Staff Present: Ned Williams, Bob Harberg, Carol Ellinghouse, Craig Skeie, Joe Taddeucci, Kim Elkins, Brett Linenfelser, Betty Solek

Consultants Present: Barbara Lewis, Jenny McCurdy, Lee Rozaklis, Tracy Koslof, Kris Kranzush

Public Present: Jim Knopf, Bill DeOreo (WRAB Members), Jennifer Rice (Western Water Assessment)

Next meeting: Thursday February 28, 2008, 4:00-7:00 p.m. West Boulder Senior Center, Creekside Room

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I. Introductions and Welcome, Ned Williams, Asst. Director of Public Works for Utilities

Ned Williams welcomed the group. The purpose of the group is to learn more about Boulder's water system and to help develop recommendations for future studies. All WRAB members are present today. There are three appointees from WRAB, Robin Byers, Kelly DiNatale and Bart Miller. There are also two City Council appointees – Matt Appelbaum and Ken Wilson.

Barb Lewis asked for revisions to the meeting #2 summary. Barb has one revision – the exact language of the question about water shortages asked of the group should be used. Final summaries for both meeting #1 and #2 will be distributed prior to the next meeting.

There is a lot to get done today. First will be a presentation from Lee Rozaklis on non-municipal water uses, and then Kim Elkins will do a presentation on watershed management. Time is available for questions and answers. There is a sticky wall on which we will gather the group's ideas and then discuss the key policy questions about non-municipal uses and watershed management.

Joe is last with the facilities assessment and Capital Improvements Program. Then there will be a wrap up.

This session is being taped because Kris is having some wrist problems and can't take the usual notes.

Designing this meeting was a challenge. We tried to accommodate people with detailed comments and people who don't have detailed comments. Some of the comments we received in the homework were not directly pertinent to tonight's discussions, but they will reviewed and addressed in the Source Water Master Plan.

At the final meeting, we will return to the big picture policy questions. Before the next meeting, the group will get a draft memorandum that reflects what the group has told us to date. This will be important to review.

II. Non-Municipal Water Use Overview, Lee Rozaklis, AMEC Earth and Environmental (formerly Hydrosphere)

Lee gave a Power Point presentation on non-municipal water uses, which include instream flows, hydropower, irrigated agriculture, flow-based recreation and environmental enhancements.

Copies of his slides are attached. They are also available on the city's project Web page at www.bouldercolorado.gov . Go to the Utilities page and select Source Water Master Plan from the Projects and Programs list.

III. Questions and Responses

Q: How much over-committed are Boulder Creek and the South Platte River?

A: Those rivers are called over-appropriated. There is not a deficit all days of the year, but most months of most years have a deficit and some water rights will not be satisfied. In dry or below average years, there may be no free river for long periods of time.

Q: What is the definition of "deficit" and "over-appropriated"? Is demand the sum total of all diversion rights?

A: The definition of over-appropriated is that demand for water exceeds the supply, with windows where supply exceeds demand. We look at demands behind the water rights, what is actually needed.

Q: Does "natural flow" mean flow with no diversions?

A: We define shortages as reductions below that natural flow. It is not the ideal flow rate. For this discussion, instream flow needs are reductions below the natural flow regime.

Q: Are instream flows based on biological need? The CWCB instream flow right is way above what's actually there.

A: CWCB rights are usually less than the natural flow regime. Instream flows are based on biological needs and natural flows. They are intended to protect the **natural** environment to the greatest extent possible.

Q: How would the South Boulder Creek fish and aquatic life look if they got natural flows? Would there be a lot more fish? Would the plant life be changed?

A: In general in this region, fish populations are limited by the low flow seasons (winter and late summer). Habitat assessments take in to account several factors such as natural flow, depth, flow rate. There would be significantly more fish with natural flows, but it's also a function of water quality, flow and physical conditions of the streams. Instream flow is intended to protect the natural environment, which is based on habitat defined in terms of fish and macroinvertebrates. Plant life isn't necessarily accounted for.

If you address the low flow limitations on the fish, then peak flows become a limitation for Boulder Creek. Low flows limit the adult population, but peak flows tend to limit the number of small fish.

Q: We can provide for some non-municipal uses and it costs us nothing, but for others, water has not been available.

A: Hydropower is a slam-dunk. We have to reduce the water pressure, and instead of spending money on pressure reducing valves, we can generate hydropower.
One of the trade-offs in deciding about non-municipal uses is the ability to make a difference. For some non-municipal uses, for example, irrigated agriculture, the city can't make a large scale difference. Non-municipal uses can be conditioned to be year-to-year. If there is a large commitment needed to make a significant difference, there may not be enough water for other uses. There are matters of scale and ability to meet needs to a reasonable scale. It may be possible to supply water for irrigated agriculture in three out of 5 years, but, for example, fish need water every day.

Comment: When the CWCB files for an instream flow right, the purpose is to protect the natural environment to a reasonable degree. The water for that purpose must reasonably be there and available. They can't file for what is needed by the natural environment if the water is not reasonably expected to be there.

Comment: The city exchanges a lot of CBT water up to the watershed. If the city did want to make a choice, the city could expand the Boulder Reservoir plant to handle more and return more of the natural flow to Boulder Creek. This has trade-offs of loss of hydropower.

Q: Assuming 100% of return flows from instream flow are for instream flow, do particular downstream users benefit from the city's instream flows?

A: The city gets that part of the instream flows that was historically consumed. The part that historically went to downstream farmers still goes to downstream farmeres. The city can and has on occasion leased it's part. For Barker, though, water is just operationally bypassed and the city cannot specify the use.

Q: Who downstream benefits from the city's instream flows?

A: Ditch companies and those who need augmentation.

Q: Is the only reason Silver Lake Hydro is not used (to capacity) the instream flow requirements?

A: No. At times there is extra capacity (beyond municipal needs) in Silver Lake Pipeline. There are plenty of times when flows are way beyond instream flows that the city could generate additional energy. The city has not done that to date. There are stakeholder concerns about taking water out of the creek solely for hydropower generation.

IV. Watershed Management Overview, Kim Elkins, Water Resources

Kim gave a Power Point presentation on watershed management for North and Middle Boulder Creeks and Boulder Reservoir/Boulder Feeder Canal. She focused on the issues regarding the city's water sources. Boulder has not taken the lead in watershed management on the West Slope. The Utilities Division has not taken the lead on South Boulder Creek watershed management, because it is not a source water and Utilities does not own land in that basin. Other city departments, such as Open Space and Mountain Parks, could take the lead in that basin with Utilities support for those efforts.

Kim also introduced the Water Quality Strategic Plan and talked about its relationship to the SWMP. Copies of her slides are attached. They are also available on the city's project Web page at www.bouldercolorado.gov . Go to the Utilities page and select Source Water Master Plan from the Projects and Programs list.

V. Questions and Responses

Q: Is there drainage that by-passes the Boulder Feeder Canal?

A: There are pipes over the feeder canal. On the slide, the purple shows the areas where drainage is not carried over the canal. These areas drain agricultural lands, roads and commercial and industrial properties. The city is now addressing high priority outfalls to the canal.

Q: South Boulder Creek is routed through KOA Lake when it should flow around it. Is that a concern?

A: Open Space has taken the lead so far on the physical aspects of South Boulder Creek. Utilities has worked with Boulder County on the lower end of the stream near the gravel pits. Xcel will have to take the lead on the water temperature issue, since they cause it.

Q: Is there any water quality concern with chemicals used in snow making at Eldora?

A: There is currently an augmentation plan in water court pertaining to the snow making, but it doesn't include water quality aspects. There is information on septic systems compiled by Boulder County. The city is not aware that chemicals are added in snow-making at Eldora.

Q: Has Boulder County evaluated how the fire hazard ratings may change in light of the beetle-kill problem?

A: The information presented here is older. It is not known how far down the road a beetle-kill assessment will be.

Q: With regard to National Forest lands, how do you expect to deal with beetle kills and fire? The Forest Service is placing more emphasis on controlled burns. Thinning projects have been poorly done and have led to new roads. City interaction with USFS will be interesting.

A. The Forest Service is forming a task force with the Colorado State Forest Service and water providers and wants to make greater use of individual watershed management plans. Middle Boulder Creek is the city's most vulnerable water supply with regard to fire. We will have to work with USFS and Boulder County in that area.

Q: There are new state standards concerning water temperature as a part of water quality. Is the city taking water temperature for habitat into account?

A: Water temperature is part of the city's water quality monitoring program. On the lower portions of the system, where the city can have problems with temperature, 15-minute monitoring has been implemented.

Q: Does the city post its water quality data anyplace?

A: No.

Q: Who is taking part in the watershed plans for forested areas?

A: It will come out of groups like the regional task force and will include stakeholders in individual basins.

Q: Will a Middle Boulder Creek watershed plan take into account sediment retention as a safeguard against fire problems?

A: That would be a strategy, if it's appropriate to individual basins.

Barb asked group members to post their ideas concerning non-municipal uses and watershed management by area or as global issues….what would you like to see, why do you think it's important, and what is the mechanism by which that would get accomplished. These may be changes to consider or things you would like to see not change. There is an area to make comments about the Water Quality Strategic Plan. There is an area to comment on watershed management.

If you have extra time, please get with Kris to refine why you thought any water supply ideas for the future are good ideas. We would like the memo to contain information on why you thought these were good ideas.

Following the exercise, the comments were read. Comments from the sticky board are attached to this summary. General questions and comments related to the exercise were:

- Nobody mentioned bypassing Barker Reservoir with Nederland's effluent and discharging it below the dam.
- BASIN.org has monthly water quality monitoring data posted on its Web site.
- Minimizing trans-basin water diversions is good.
- Nederland has received DRCOG approval for modifying its wastewater treatment plant and is in the process of constructing. Costs range from $1.4 to 1.7 million. Nederland has asked if Boulder is interested in contributing the $300,000 increment that would add a membrane bioreactor to improve pathogen removal. The city might be able to make this funding available in 2009.
- Does the Nederland effluent create taste or odor problems? (It is primarily a concern with pathogens.)
- Effluent also contains endocrine-disrupting compounds, such as estrogens.
- The effluent from Nederland is diluted by a big reservoir. There is no dilution for effluent discharges from the Eldorado Springs waste water treatment plant.
- How much of Nederland is served by the wastewater treatment plant vs. septic systems. (Nederland has voted to connect the Big Springs subdivision directly south of Barker Reservoir and construction has begun. That will take care of a large part of the concern for Barker Reservoir.)

A discussion concerning policy considerations, trade-offs and factors to be considered in evaluating the ideas, as well as priorities followed. Which of the suggestions are priorities or seem most important? Can commitments to new uses (municipal or non-municipal) be made based on our current knowledge and assumptions? Or should we refrain because there will always be uncertainty? Comments from the discussion are summarized below:

- In terms of prioritizing non-municipal uses, the city's legal obligations are at the top of the list.
- How flexible the commitments are is important.
- "No regrets" opportunities are important. It's important that any non-municipal use is not forever and is flexible.
- A more global perspective is that the non-municipal uses are what citizens expect Boulder to provide to maintain the water features that people live here for.
- Higher priority should be given to uses with multiple benefits, for example, if water can first be used for instream flow, then for agricultural lease. The benefits of sequential uses should be considered.
- Other storage opportunities further up in the watershed need to be evaluated in terms of how much they would cost and how much they would help.
- At Gross Reservoir, there is the potential for a little additional storage to go a long way.
- Enlargement of Gross Reservoir will inundate a significant reach of stream, and there will likely be mitigation requirements for doing so.
- Adding hydropower generation at the base of Barker Dam is a benign use of an existing dam which has very little impact on Middle Boulder Creek.
- The payback period for hydro projects is the life of the project.
- The city has a preliminary design for new outlet works for Barker Reservoir which could have hydro put on it. The full range of discharges from the reservoir was cost-effective. This project may be pursued after the Boulder Canyon Hydro exemption process is completed.
- The city is repairing Barker Gravity Line to restore its capacity, not replacing it to increase its capacity.

VI. Capital Improvement Projects Overview, Joe Taddeucci, SWMP Project Manager

Joe gave a Power Point presentation on the Utilities Division Capital Improvements Program. Copies of his slides are attached. They are also available on the city's project Web page at

www.bouldercolorado.gov . Go to the Utilities page and select Source Water Master Plan from the Projects and Programs list.

The SWMP will define the projects to pursue over the next 10 to 20 years. The Capital Improvements Program is just the beginning of the approval process each project must go through. The SWMP will contain a list of projects based on input from the CSG, from the MWH facilities assessment being prepared for the SWMP and from a staff survey.

Carter Lake Pipeline has a budget of $1 million for 2008. This is intended to start permitting efforts, complete a Community and Environmental Assessment Process, and complete some right-of-way acquisition activities. This funding will keep the door open on the project, but the real decision on the project is upcoming.

VII. Comments, Questions and Responses

Q: Will the Carter Lake Pipeline operate year-round?

A: Yes. Carter Lake Pipeline will increase the flexibility of operations. It is important for water supply as well as water quality.

Q: Why is relicensing for Boulder Canyon Hydro so expensive?

A: Relicensing is an extensive and complicated federal process. The budgeted amount is for obtaining an exemption from licensing, which is substantially less than relicensing.

Comment: It is hoped that WRAB will see a cost break-out for Boulder Canyon relicensing in the next budgeting process. It's not clear that it is cost-effective.

Q: Is $2.8 million in relicensing cost-effective to get $200,000 in annual revenue?

A: The exemption would remove all but the power plant from federal jurisdiction. There is currently a license which the city has to do something with. If Boulder were to abandon the project, there would be expenses related to that, and someone else could take the project over, potentially causing impacts to municipal water deliveries. An existing license cannot just be walked away from.

Q: Is the city receiving Renewable Energy Credits, and what is being done with them?

A: This is being discussed by the City Attorney's Office and Xcel. The current contract with Xcel does not cover Renewable Energy Credits.

Comment: It would be helpful to develop costs and timing for things suggested by the CSG. This would allow them to be evaluated as part of the mix in the CIP.

Q: What are the reasons for Carter Lake Pipeline?

A: One aspect is water quality protection. Carter Lake Pipeline would also increase system flexibility by providing a means of delivering to the water treatment plant in winter and a third means of delivering water to Boulder Reservoir. There are water quality problems related to taking water from the reservoir at certain times of year.

Q: Has the Boulder Feeder Canal trail been approved?

A: The city and Boulder County are developing the funding to build the trail. Approval from NCWCD is still needed. Approval of the transportation tax last fall will allow the project to move ahead.

Q: Will the pipeline be in the canal?

A: Most alternatives for the Carter Lake Pipeline will follow the existing Southern Water Supply Pipeline which transports water to Louisville and Broomfield.

Q: Will there still be water in the canal if the pipeline is built?

A: Water that is being delivered to users other than Boulder will remain in the canal. The city's exchange water will remain in the canal. WRAB has reviewed a lot of information on the Carter Lake Pipeline which is available.

Comment: Consideration of project timing and cost in relation to other CIP needs and the need to significantly raise rates is needed.

Q: Will Carter Lake Pipeline require raising rates?

A: Yes, but treatment upgrades that could be needed if the pipeline isn't built might also require raising rates.

Comment: Carter Lake Pipeline is also needed by Left Hand Water to provide a reliable source of water.

Q: Why are the city's water rates in the mid- to high-range of Front Range communities when the city has had its water rights for so many years?

A: Two-thirds of the cost of the system is related to infrastructure, not acquisition of water rights.

Q: The 1988 Raw Water Master Plan suggested that the city should examine the utility of its water right associated with Skyscraper Reservoir. Has this ever been done? Has the city ever done any maintenance work on the dam since purchasing the reservoir in 1967? Granted this is a small reservoir, but like all the other source water facilities it makes sense to maintain it.[1]

A: The 2003 Drought Plan recommended that the city formally incorporate the operation of Skyscraper Reservoir into its water supply system on a normal basis. Skyscraper Reservoir maintenance will be included in the long-range capital improvement projects list being prepared for inclusion in the SWMP.

Comment: In terms of approving any major expense, the CIP has had a short-window and much uncertainty beyond five years. What else needs to be done? When will bonds be paid off? Could rate increases be minimized by delaying a project until after some debt is retired? That kind of information would make it easier to approve the CIP.

VIII. Wrap Up

The next meeting will be at the West Senior Center. It is the last meeting of the CSG.

Pluses/What Worked Well	Minus/What Could be Done Better?
-The food is appreciated.	-Break out sessions would help discussion.
-The sticky wall was useful.	-If there will be an exercise, advance
-Power Point Presentations were helpful.	explanation would be helpful.
-Advance feedback was helpful.	-More time is needed if there is an

[1] This comment was submitted via email in advance of the meeting, but not discussed at the meeting.

- Attendance was great.

exercise.
- Better acoustics are needed.

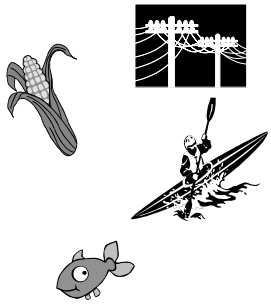
Attachments: 3 Power Points
Summary of “Sticky Board”
Roster

Non-Municipal Water Uses

City of Boulder
Source Water Master Plan
Community Study Group
January 15, 2008

What Are Non-Municipal Uses?

- Instream Flows
- Hydropower
- Irrigated Agriculture
- Flow-Based Recreation
- Environmental Enhancements



Adopted Policies Regarding Non-Municipal Water

BVCP 3.10 Utility Provision to Implement Community Goals

The city will consider the importance of other objectives of the comprehensive plan in the planning and operation of water, wastewater, stormwater and flood management utilities. These other objectives include instream flow maintenance, enhancement of recreational opportunities, water quality management, preservation of natural ecosystems, open space and irrigated agricultural land, and implementation of desired timing and location of growth patterns."

(Hydropower policies set in Climate Action Plan and Council approvals for hydro program development)

Instream Flow Considerations

- Basis for instream flow: natural conditions
- Deficits are due to diversions
- Needs can be quantified by flow/habitat studies
- Specific amounts, locations and seasons
- Minimum ISF needs in Boulder Creek basin are relatively small – potentially within Boulder's ability to address

Hydropower Considerations

- Defined as hydropower generation appurtenant to Boulder's water supply system
- No trade-offs with other uses except for Boulder Canyon Hydro and part of Silver Lake Hydro generation
  - Other hydros generate using only municipal deliveries
  - Silver Lake Hydro could also generate using additional stream flow, subject to ISF needs, in addition to municipal deliveries; returns to NBC at Lakewood
  - Boulder Canyon Hydro water returned at Orodell, subject to Boulder's municipal deliveries and ISF bypasses

Irrigated Agriculture Considerations

- Deficits are due to Colorado's semi-arid climate: irrigable land vastly exceeds available supply
- Needs are based on human expectations
- Needs exist throughout South Platte basin
- Shortages in nearly all years
- Needs are relatively large – beyond Boulder's ability to address

Recreation Considerations

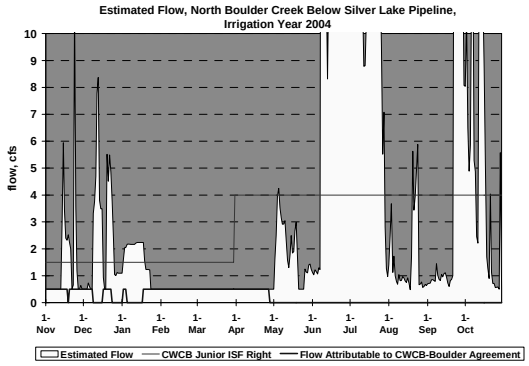
- Defined as flow-related uses: kayaking, tubing
- Deficits due to snowmelt-driven hydrology
- Needs can be estimated based on hydraulic analysis and human expectations
- Primary location: Boulder Creek from Eben G. Fine Park to Broadway, but others as well
- Needs are relatively large - beyond Boulder's ability to address

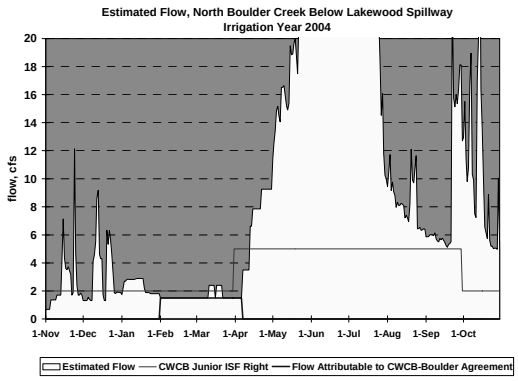
Environmental Enhancements Considerations

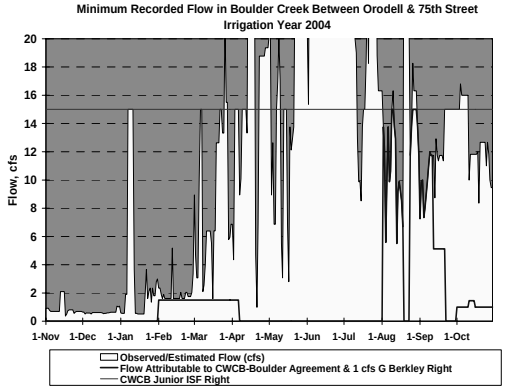
- Defined as municipally-owned ponds and wetlands
- Deficits due to physical supply and water rights
- Needs based on site-specific studies
- Specific amounts, locations and seasons
- Needs are relatively small – potentially within Boulder's ability to address

Current Status – Instream Flow

1. **North Boulder Creek and Main Boulder Creek**
   - **Donation agreements partially address needs**
   - **Issues: late summer/fall/winter flow deficits on Main Boulder Creek and North Boulder Creek**

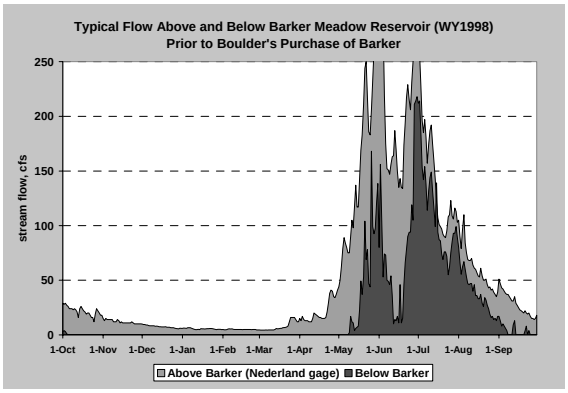


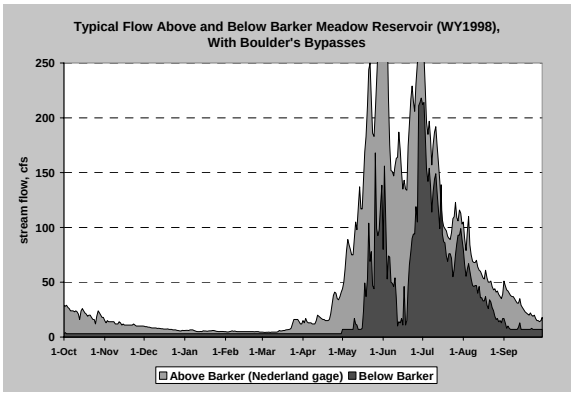




Current Status – Instream Flow

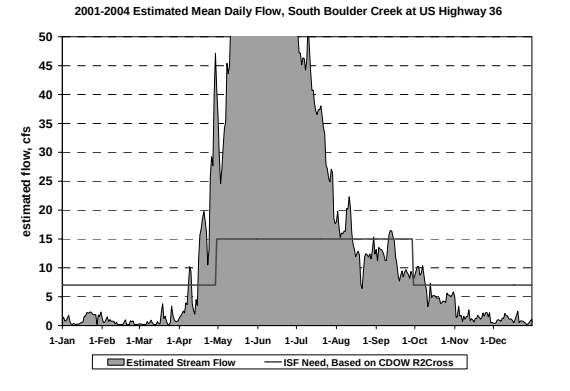
1. North Boulder Creek and Main Boulder Creek
   - Donation agreements partially address needs
   - Issues: late summer/fall/winter flow deficits on Main Boulder Creek and North Boulder Creek
2. **Middle Boulder Creek**
   - **Boulder's bypasses address needs as defined by habitat studies**
   - **Issues: There is no CWCB ISF right, is it needed? Are 3 cfs and 7 cfs sufficient?**





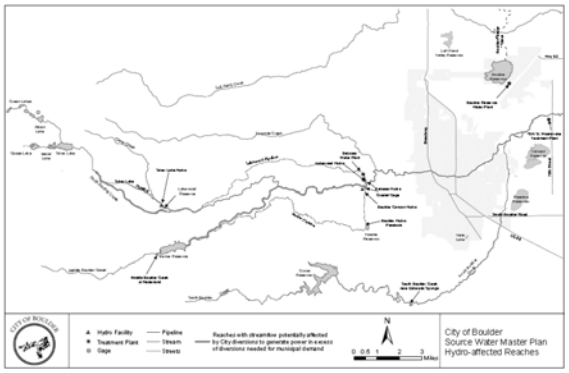
Current Status – Instream Flow

1. North Boulder Creek and Main Boulder Creek
   - Donation agreements partially address needs
   - Issues: late summer/fall/winter flow deficits on Main Boulder Creek and North Boulder Creek
2. Middle Boulder Creek
   - Boulder's bypasses address needs as defined by habitat studies
   - No CWCB ISF right, but is it needed? Are 3 cfs and 7 cfs sufficient?
3. **South Boulder Creek**
   - **November – mid-April flow deficits from Eldorado gage to South Boulder Road**
   - **More extensive flow deficits in downstream reaches**
   - **Solutions would involve multiple parties: Boulder Utilities, OSMP and Parks; Xcel Energy; Lafayette; FRICO; Denver Water**



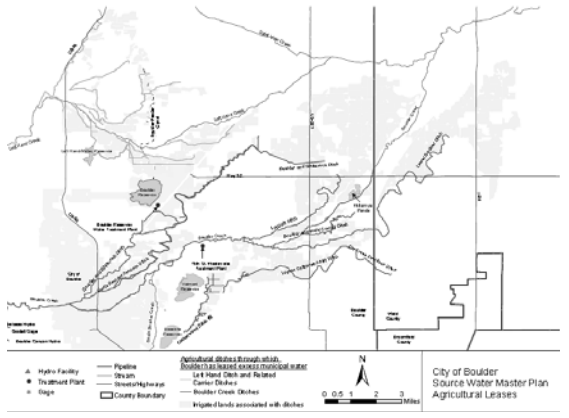
Current Status – Hydropower

- Hydroelectric power generated as by-product of city water supply system driven by water demand
- Hydro generation counted as part of meeting City Climate Action Plan goals; to date, city hydro production has offset burning of 23,000 tons of coal and provides clean, renewable power for 8200 homes
- Currently, generation uses only municipal water deliveries, except at Boulder Canyon Hydro which uses mostly natural streamflow, subject to Boulder's bypasses below Barker Reservoir and minimum flow limits for turbines
- Generation at Silver Lake Hydro could be increased by diverting additional streamflow
- Sites remain for new generation facilities (Betasso discharge pipeline, Barker Reservoir outlet hydro, 101 Pearl Street)



Current Status – Irrigated Agriculture

- Boulder leases lower elevation source water to Boulder Creek and Left Hand Creek farmers
- Leases are single-year only, subject to filling Boulder's reservoirs, meeting Boulder's municipal needs, and meeting needs of the existing instream flow program, wetlands enhancement, and ponds
- Leased sources include CBT water, Baseline Reservoir water, Left Hand Ditch water, reusable instream flow water and Windy Gap return flows



Current Status - Recreation Flows

- Utilities-defined goal of maintaining existing flow regime to allow for peak flow levels sufficient for recreational boating on Boulder Creek from Eben G. Fine Park to 75th Street in the month of June during normal to above-normal flow years.
- Kayaking: preferred flows 250 – 450 cfs (class IV & down to 150 (class III-) below Orodell through Water Park to 30th
- Tubing: preferred flows 150 – 250 cfs Eben G. Fine to Broadway

Current Status – Environmental Enhancements

- In addition to the instream flow program, the City may annually lease surplus water for wetlands enhancement, ponds, and aesthetics
- Currently identified potential needs:
  Viele Lake, Burke Lake

Moving Forward

Considerations and Questions

Water Supply Status- Recap from 11/27 presentation

- System can meet at least 28,600 AF build-out demand in all but worst climate change scenarios
- New build-out demand estimate will be lower due to new demographic projections and additional water conservation savings (beyond projected 10% savings) that are likely to occur

Conservation as New Supply for Non-Municipal Uses

- Some of conserved water may be available for other uses – mostly water from reservoirs
  - Some (34%) of Boulder's needs in May -July are met with CBT supplies.
  - Most (72%) of the Boulder's needs in August - April are met with CBT supplies and releases from reservoirs.
- Water rights considerations affect what types of uses can be made

Current Priorities for Available Water

- First: assure that adopted municipal water supply reliability criteria and contractual water delivery obligations are met
- Next: satisfy other uses with supplies not required to meet above priorities

Policy Considerations

- Problem recognized in 1988 RWMP:
  long-term commitment of City's municipal water supplies to non-municipal uses would reduce water system reliability
- Solution: reliability criteria for municipal service were established, allowing Boulder to address non-municipal uses so long as criteria are met
- Reliability effects of potential commitments to non-municipal uses can be assessed via modeling.

Questions - Uncertainty

- Can commitments to new uses (municipal and non-municipal) be made based on our current knowledge and assumptions?
- Or should we refrain from new commitments given there will <u>always</u> be uncertainty regarding our ability to meet municipal use reliability criteria?
- Or should new commitments be limited in some way - i.e. only for new municipal uses, or for non-municipal uses with drought reservations?

Questions - Motivations

City Council adopted a water conservation program with a goal of 10% reduction in per-capita use by build-out.

To what degree is customers' "buy in" to this program (and to additional conservation) based upon a desire to:

- Simply use resources more carefully?
- Increase reliability of existing municipal uses?
- Increase instream flows?
- Provide more water to agriculture?
- Meet other non-municipal uses?
- Serve new growth?
- Other?

Questions – Priorities

- Which non-municipal uses should have priority?
  - Instream flows? Hydropower? Recreational flows? Agriculture? Neighborhood lakes?
  - Instream flow: Only downstream of Boulder's municipal diversions? South Boulder Creek? Colorado River? Lower South Platte?
  - Agriculture: Boulder Creek? South Platte? West Slope?
- Should Boulder's Water Utility finance new hydro plants given payback periods of greater than ten years?
  - For hydro within municipal water system?
  - For hydro using streamflow diversion and stream discharge?
  - Priority of new hydro financing versus other municipal and non-municipal needs?

Questions - Roles

City Council establishes policy on non-municipal water uses and approves funding if needed.

- Where should the City take the lead in addressing non-municipal uses, particularly instream flows and environmental enhancements?
- For which of these uses should the Water Utility take the lead in implementing the policy and which should be lead by other departments?
- Are additional staff and financial resources needed?

Possible "No-Regrets" Options

- Non-municipal use arrangements that avoid reliability impacts even if water yield is reduced by climate change
- Interim arrangements until build-out demand is realized
- Drought reservations to minimize impacts if drought recognition thresholds are reached
- Downstream storage to recapture instream flows for later exchange upstream for municipal & non-municipal uses
- Recharging alluvial aquifers during high streamflow to increase returns to stream in low flow periods
- Improved municipal water system facilities that increase flexibility and reliability for municipal use and, therefore, more possibility of meeting non-municipal uses

Watershed Management

City of Boulder
Source Water Master Plan
Community Study Group
January 15, 2008

Overview

- Objectives of watershed management
- Issues within each source water basin
- Introduction to the Water Quality Strategic Plan

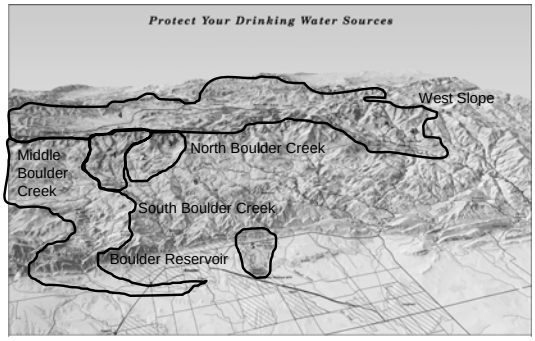
Objectives

- Water quality protection
  - Maintain or enhance quality of water
- Facility protection
  - Maintain functionality of facilities to supply water to treatment plants
- Environmental and habitat protection

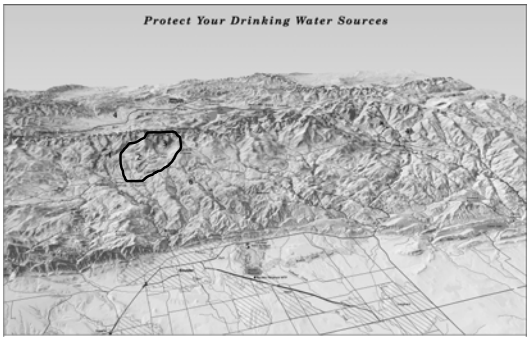
Security Vulnerability Assessment

- Finishing a vulnerability assessment for water system assets
- Facilities assessed following a standard methodology for vulnerability assessment:
  - Risks
  - Consequences
  - Current security system effectiveness
- Identifies options, costs and priorities for improvement measures

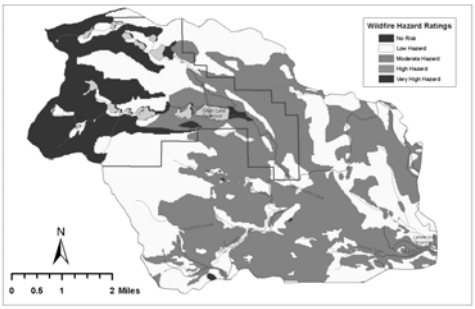
Source Water Basins



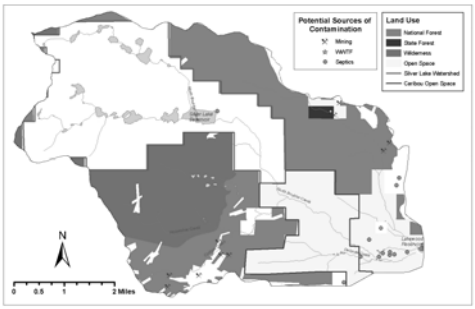
North Boulder Creek



North Boulder Creek
Wildfire Hazard



North Boulder Creek
Few Potential Sources of Contamination



North Boulder Creek
Interests

- Preserve alpine research site in Silver Lake Watershed

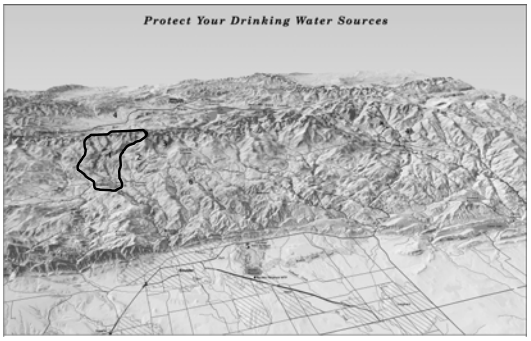
City of Boulder

Photo by Tom Wolff Mussehl

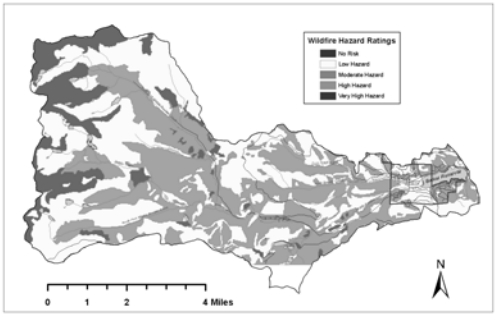
- Wildlife habitat protection
  - Elk calving area
  - Greenback cutthroat trout
  - Protect from non-native aquatic plants and animals
  - Instream flow

Courtesy of the Colorado Division of Wildlife

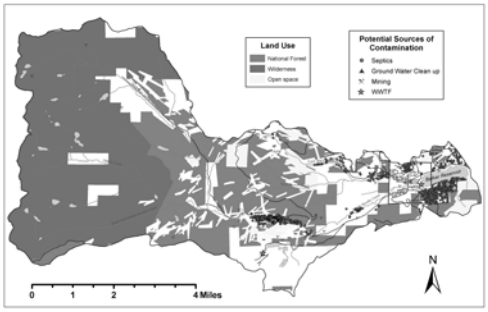
Middle Boulder Creek



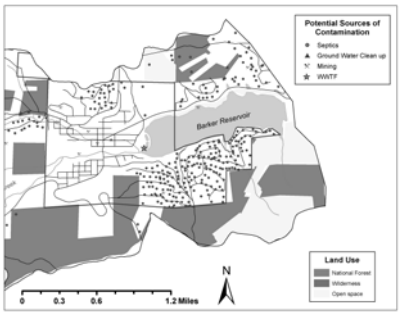
Middle Boulder Creek
Wildfire Hazard



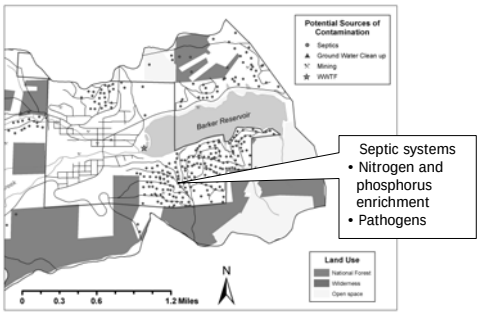
Middle Boulder Creek
Potential Sources of Contamination



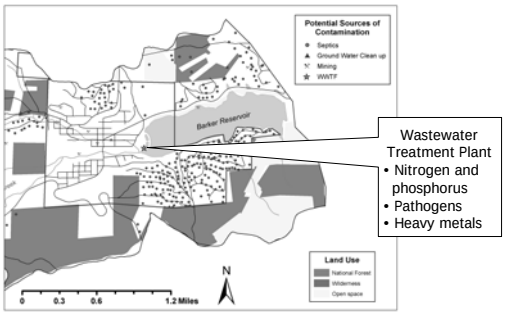
Middle Boulder Creek Potential Sources of Contamination



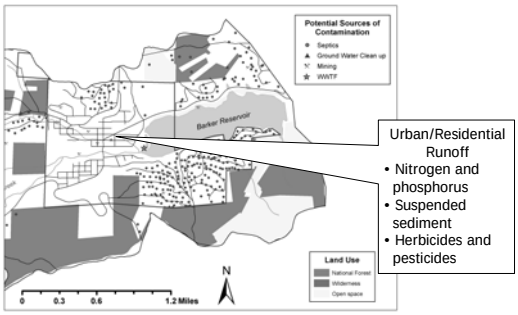
Septic systems



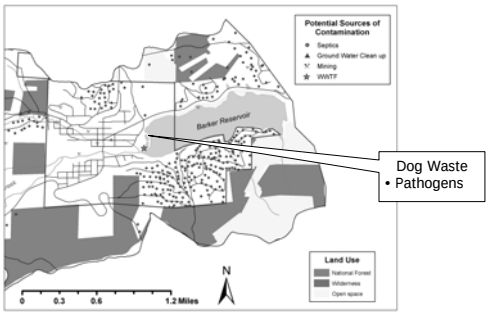
Wastewater Treatment Plant Effluent



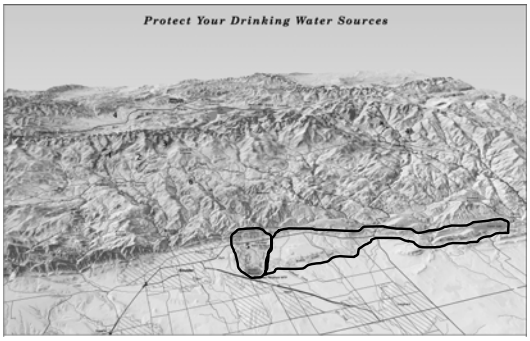
Urban and Residential Runoff



Dog Waste

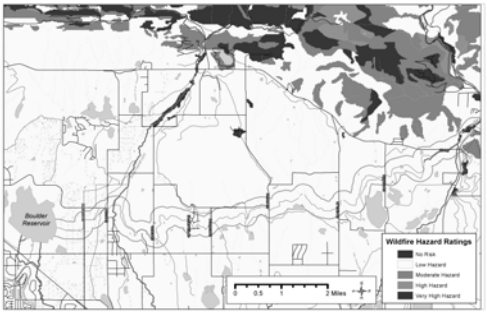


Boulder Reservoir



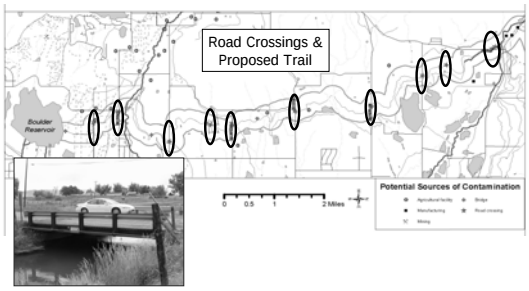
Boulder Reservoir
Wildfire Hazard

Boulder Feeder Canal
Wildfire Hazard

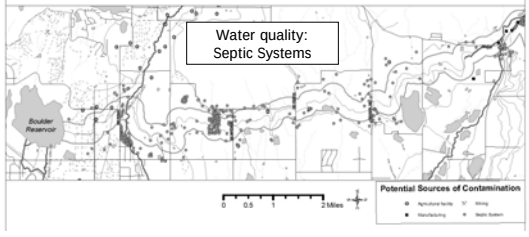


Boulder Feeder Canal
Potential Sources of Contamination

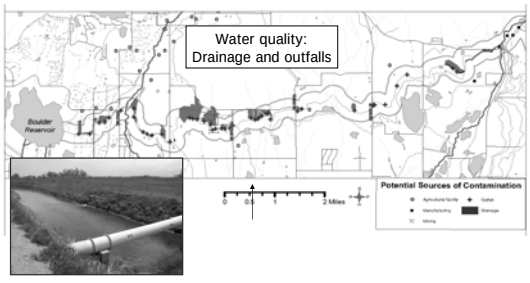
Boulder Feeder Canal
Low Security Along the Canal



Boulder Feeder Canal
Numerous Septic Systems

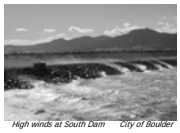


Boulder Feeder Canal
Numerous Drainage and Outfalls

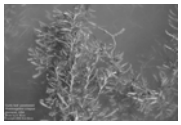


Boulder Reservoir Water Quality

- Human activity in and around reservoir affects water quality
- High turbidity from wind events
- High mineral content because of basin soil
- Low oxygen concentrations in summer
- Invasive aquatic plants and animals



High winds at South Dam City of Boulder



Curly leaf pondweed Photo by A. Bove

West Slope Watershed Management

- Vulnerability to Debris Flow Post-Fire (USGS)
- CBT Nutrient Project (NCWCD, BOR)
  - Sediment in Shadow Mountain Reservoir
  - Rooted aquatic vegetation in Shadow Mountain Reservoir
  - Algae toxins and blooms in Three Lakes system
  - Effect of Windy Gap project of Three Lakes system water quality

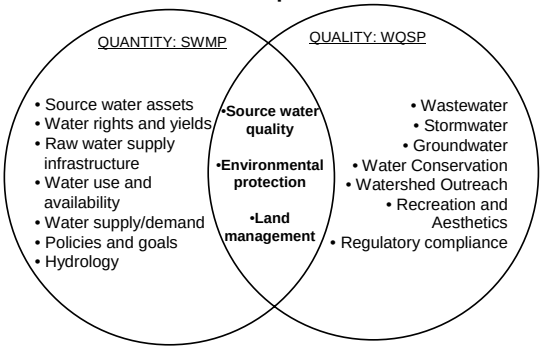
South Boulder Creek Issues

- Instream flow
- Temperature of discharge from Valmont ponds
- Lack of channel definition on the lower end near Valmont ponds

Water Quality Strategic Plan

- **Parallel process by city's water quality group**
- **Supports city and regional water quality protection and enhancement**

How do the plans relate?



Questions?

Facilities Assessment / Capital Improvement Projects (CIP)

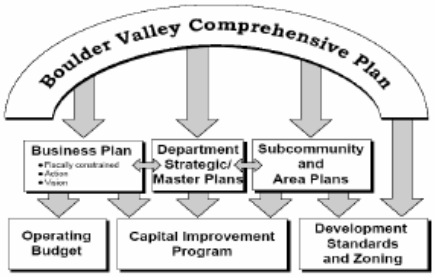
CITY OF BOULDER
DEPARTMENT OF PUBLIC WORKS
Utilities Division

Community Study Group Meeting 3 – January 15, 2007

What projects get built?

- How does the process work?
- What considerations guide the CIP?
- What projects have city staff identified as important candidates?

Where does the CIP fit?



How do projects get approved?

- Project Planning and Approval Process Handbook
  - outlines city review and approval process for capital improvement projects
- Community and Environmental Assessment Process
- Checks and balances

CITY OF BOULDER
2008 - 2013 CAPITAL IMPROVEMENT PROGRAM
WATER UTILITY FUND

PROJECT NAME	2008 thru 2013 PROJECTED TOTAL
Source Water Transmission System	
Lakewood Pipeline (various accounts)	$5,200,000
Source Water Transmission Pipe Inspections	$160,000
Barker Water System	
Barker Gravity Pipeline Repair	$5,750,000
Barker Dam Outlet	$1,000,000
Barker Hydro System Integration	$200,000
Barker Relicensing	$2,800,000
Raw Water Storage Reservoirs	
Albion Dam	$150,000
Green Lake 2 Dam	$1,100,000
Lakewood Reservoir Dam	$250,000
Other Raw Water Facilities	
Instream Flow Structures and Gaging	$50,000
NCWCD Conveyance - Carter Lake Pipeline	$19,220,000
Source Water Pressure Reducing, Pumping and Hydroelectric	
Boulder Reservoir Intake and Pumping	$100,000
Water System Monitoring and Metering	
Water System Security Upgrades	$600,000
SUBTOTAL (SELECTED SOURCE WATER PROJECTS)	$36,580,000

Project Example

- Carter Lake Pipeline
  - CIP status
  - Cost/funding
  - Next Steps

CITY OF BOULDER
2008 - 2013 CAPITAL IMPROVEMENT PROGRAM
WATER UTILITY FUND

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Water System Monitoring and Metering	
Water System Security Upgrades	$600,000
SUBTOTAL (SELECTED SOURCE WATER PROJECTS)	$36,580,000

What considerations guide the CIP?

1. Reliability of water supply, treatment and delivery
2. Water quality and other environmental regulations
3. Public and worker health and safety
4. Opportunity to collaborate with other projects and programs
5. Potential for operation and maintenance cost savings
6. Accommodating new growth and development

Questions

January 15, 2008
Boulder Source Water Master Plan
Community Study Group Sticky Wall Comments

Wall 1

Non-municipal Use - Instream Flows

Main Boulder Creek

1. **Explore the possibility of extending main-stem instream flow along Boulder Creek to the County Line. There are significant habitat/quality concerns on the lower creek.**
2. **What: Quantify historic impact of Boulder's exchange right on Boulder Creek flows**

Middle Boulder Creek

1. **What: Conduct mitigation studies and recommendations for the Barker pipeline break of 2006**

   Why: To address downstream sediment impaction resulting from the pipeline break

2. **What: Conduct independent EIS studies for the Barker Boulder Canyon Hydro relicensing.**

   Why: to evaluate flow regimes, sediment deposition and wildlife impacts from hydroelectric operations

North Boulder Creek

1. **What: Treat more water at Boulder Reservoir rather than exchange to Betasso**

   Why: Can provide for additional flow in Middle and North Boulder Creek

2. **What: Increase minimum flows in North Boulder Creek**

   Why: Improve aquatic habitat

   How: Rehabilitation of Green Lake #2

South Boulder Creek

1. **What: More Instream flows to South Boulder Creek.**

   Why: To improve fish habitat and esthetics

   How: Buy more water rights

2. **What: Line Wittemeyer Ponds**

   Why: To increase municipal storage and exchange opportunities and for improved Instream flows

   How: Provide funding for the lining & also for a return pipeline from Baseline reservoir

3. **What: Stop suing FRICO**

   Why: FRICO would be more willing to work with the City on South Boulder Creek flows

4. **What: Remove/reconstruct diversion structures on South Boulder Creek**

   Why: To provide fish passage

   How: CIP funding

5. **What: Construct a return path pipeline from Baseline Reservoir to South Boulder Creek**

   Why: Improve Instream flows between Baseline and the confluence

6. **What: Improve Instream flows**

   How: Buy South Boulder Creek water rights as available

7. **What: Gross Reservoir environmental pool management and strategic plan development regarding Denver Water's pending EIS for Gross expansion**

   Why: For increased municipal and exchange opportunities for improved Instream flows

   How: Set aside CIP funding for Boulder to participate in Denver Water's Gross Enlargement to firm the environmental pool. Renegotiate the Gross environmental pool agreement to be permanent storage.

8. **What: Be involved in discussions with Denver Water to possibly restructure how water is delivered through Gross Reservoir**

Wall 2

Non-Municipal Use – Hydropower

1. **What: Add Hydro to Barker**

   Why: Source of clean energy

   How: Add to CIP

2. **What: Generate hydropower if Carter Lake pipeline is constructed**

3. **Comment: Is hydropower still cost-effective compared to other alternative energy sources?**

4. **Comment: Funding and Rate Impacts**

Non-Municipal Use – Recreation

1. **What: Develop a carrying capacity for recreation at Boulder Reservoir. Manage impacts to water quality. Have reasoned justifications if/when use needs to be curtailed.**

2. **What: Non-motorized recreation on Barker Reservoir**

Non-municipal Use – Irrigated Agriculture

1. **What: Make preservation of agricultural ditches within the City a priority due to their watershed benefits.**

2. **What: Preserve agricultural ditches in the City.**

   Why: Riparian, stormwater and other benefits, and reduces chemical uses by using raw versus treated water for irrigation

Non-Municipal Use – Environment

1. **What: Dedicate CIP funding to retrofit diversions for fish passage and other habitat improvements above Barker Reservoir.**

2. **What: Are channel defining flows an important physical consideration (to deal with floods)? Are minimum flows adequate to remove traction gravel from fish habitats?**

   Why: Sedimentation in Boulder Creek below Barker

3. **What: Speculative Water Quality security question: Will EPA's current rule-making on 1080 allow grater availability of this chemical to pollute water supplies (comment deadline is in 45 days!)**

4. **What: Water quality at Barker (treat at Nederland discharge)**

   Why: Less water quality treatment at Betasso

5. **What: Barker Pipeline erosion control**

6. **What: Wildlife habitat management.**
   - **Protection from non-native infestations (e.g. Eurasian Milfoil, New Zealand mud snails, Whirling Disease)**
   - **Maintenance of riparian zones**
   - **Establish restricted grazing access to minimize bank erosion (temporary snow fencing during grazing periods)**

7. **What: Participate in the Middle Boulder Creek Rogers Park Habitat Improvement project with Boulder Flycasters through in-kind and CIP appropriations.**

8. **What: Watershed plans for non-source water sections of our watersheds – Goose Creek & Bear Creek, etc.**

9. **What: Minimize trans-basin diversions as part of the comprehensive plan and watershed policies.**

Wall 3

<u>Watershed Management – Global Issues</u>

1. **What: Develop plan for shutting off intakes in case of wildfire erosion.**

   Why: Can't prevent all fires. Do we have enough supply if one water supply is out of commission?

2. **What: Monitor long term nitrogen deposition in alpine lakes.**

   Why: To monitor long term nitrogen deposition in alpine lakes.

3. **What: Develop a plan for pine bark beetle infestation.**

4. **What: Protect water supply**

   Why: Fire breaks won't provide the needed protection if all of the trees die.

<u>Watershed Management – Boulder Reservoir/Feeder Canal</u>

1. **What: Make stormwater bypass of high risk discharge areas to the Boulder Feeder Canal a top priority.**

   Why: These areas may have the potential of putting our water supply at risk.

2. **What: Install turbidity monitors under bridges along the Boulder Feeder Canal if concerned about turbidity spikes.**

   Why: This could provide adequate pre-treatment warning.

3. **What: Water Quality along Boulder Feeder Canal.**

   Why: Decrease treatment costs.

   How: Limit dog and horse use.

4. **What: Support trail along the feeder canal.**

5. **What: Justification for Carter Lake Pipeline**

   Why: High cost and questionable benefits

6. **What: Move ahead with Carter Pipeline**

   Why: Addresses contamination issues and provides operational flexibility
   How: cooperate with other users to fund pipeline
7. **What: How many more water quality monitoring stations are needed on the Boulder Feeder Canal to give adequate warning of a pollution incident?**

8. **What: Price estimate for pipe lining Boulder Feeder Canal seems lower than estimates mentioned in the *<u>Camera</u>*. How much cost-sharing with other communities getting Southern Water Supply Water through the Boulder Feeder Canal?**

Watershed Management – Middle Boulder Creek

1. **What: Protect water supplies (both quality and quantity)**

   How: Fire hazard mitigation/ forest health

2. **What: Allow non-motorized boating on Barker**

   Why: Large benefits, low cost

   How: Arrange with Nederland

3. **What: Allow limited recreation use at Barker**

   Why: Risks are low and creates good will with Nederland on other greater risks.

4. **What: Continued cooperation with the town of Nederland**

   Why: To minimize impacts from all sources of pollution

5. **What: Nederland pollution sources**

   Why: Direct influence on Barker

   How: Continue to treat and intercept contaminants or make Nederland and County pay for additional treatment)

6. **What: Determine number of potential exempted domestic wells, and whether this could cause significant depletions to water quantity.**

7. **What: Reduce Nederland's discharge of effluent into Barker**

   Why: Improve water quality

   How: Twist Nederland's arms and /or pay

8. **What: Kossler Reservoir is the weakest link and highest risk in Boulder's raw water supply**

   Why: Easy access (trespass) makes contamination relatively simple as it is next to a road and there is no dilution of these flows before they enter the Betasso Water Treatment Plant

9. **What: Address Nederland's discharge to Barker**

Why: Trade boating on Barker for a solution to the Nederland discharge

10. **What: Construct bypass of Nederland wastewater around Barker**

11. **What: Eldora Ski area discharges**

12. **What: More vigilant supervision of Barker Reservoir to control wastewater from Nederland. Maybe strong watershed planning**

    Why: Reduce more costly treatment

13. **What: Regarding old mines - Has the County decided to ban cyanide heap leach gold mining to protect water quality, like Summit County?**

<u>Watershed Management – North Boulder Creek</u>

1. **What: Keep Silver Lake Watershed closed to public access**

   Why: To protect the quality of the water supply, and to protect the wilderness aspects of the watershed.

2. **What: Should management of North Boulder Creek change is light of changed status of the greenback trout?**

<u>Watershed Management – West Slope</u>

1. **What: Develop West Slope protection plan in cooperation with other CBT users**

   Why: Defines responsibilities and provides cooperative response to problems. Also combines funding for addressing issues

   How: Work with Northern to create a more comprehensive SWPP *(Source Water Protection Plan?)*

2. **What: Watch what the West Slope is doing with forest management following beetle-kill**

   Why: Learn from their experiences as we are behind them

<u>Watershed Management – South Boulder Creek</u>

1. **What: Cooperate with Eldorado springs Water and Sewer District to protect the boulder Open Space/ South Boulder Creek watershed**

2. **What: Establish immediate water quality monitoring to measure the effects of:**
    - **Pesticide & herbicide use**
    - **Livestock grazing**
    - **Riparian buffer zones**
    - **Enforcement of open space visitor regulations**

3. **What: Decrease water quality impacts of stormwater runoff**

   Why: Improve water quality after storm events

   How: Landscaping changes (e.g. mitigate parking lot runoff)

<u>Water Quality Strategic Plan Comments and Questions</u>

1. **Septics, land use in North Boulder Creek and Middle Boulder Creek**

2. **Wildfire or beetle kills of trees and impacts from runoff on water quality and treatment**

3. **Stormwater runoff improvement through commercial landscaping ordinance**

4. **Water quality improvement at Barker (Nederland wastewater)**

5. **Continued cooperation with Nederland and others to control residential and urban runoff through best management practices**

6. **Support Nederland (financially and otherwise) in upgrading its wastewater treatment plant**

7. **Public accessible water quality monitoring throughout the watershed (all reaches)**

Boulder Source Water Master Plan
Community Study Group
January 15, 2008

	Name	Interest Group	Email	Present 1/15
1	Bart Miller	Western Resource Advocates & WRAB	bmiller@westernresources.org	√
2	Jeff Drager or Esther Vincent	NCWCD	jdrager@ncwcd.org;evincent@ncwcd.org	
3	Catherine Gates	Silver Lake Ditch	catherine@longsgardens.com	√
4	Alan Boles	Plan Boulder County	aebolesjr@yahoo.com	√
5	Jeannette Hillery	League of Woman Voters	jmhillery915@comcast.net	√
6	Kirk Cunningham	Sierra Club	kmcunnin@juno.com	√
7	Larry Quilling	Trout Unlimited	lquilling@comcast.net	√
8	James McConnell	Dept. of Commerce Federal Labs	james.mcconnell@nist.gov	
9	Chuck Howe	Citizen	charles.howe@colorado.edu	√
10	Steve Pomerance	Citizen	stevepom335@comcast.net	
11	Peter Gowen	Citizen	pjgowen@comcast.net	√
12	Sasha Charney	Boulder County Parks and Open Space	scharney@co.boulder.co.us	√
13	Sheila Murphy	Boulder creek Watershed Initiative	sfmurphy@usgs.gov	√
14	Cal Youngberg	Citizen	cal.youngberg@ci.longmont.co.us	√
15	John Pavlovic	IBM	pavlovic@us.ibm.com	
16	Robin Byers	WRAB	robinbyers@aol.com	√
17	Kelly DiNatele	WRAB	dinatalekn@cdm.com	√
18	Ken Wilson	City Council	wilsonk@bouldercolorado.gov	√
19	Matt Appelbaum	City Council	appelbaumm@bouldercolorado.gov	√

Public/visitors & SWMP Team Present

Jennifer Rice	Western Water Assessment	jlrice@email.arizona.edu
Bill DeOreo	WRAB	bill@aquacraft.com
Jim Knoff	WRAB	jim@knoffjim.com
Craig Skeie	City of Boulder	
Bret Linenfelser	City of Boulder	
Carol Ellinghouse	City of Boulder	
Joe Taddeucci	City of Boulder	
Kim Elkins	City of Boulder	

If anyone from the public wishes to receive materails and notification for subsequent CSG meetings, please add you name and email address to this roster. Thank you!

Boulder Source Water Master Plan
Community Study Group
January 15, 2008

Ned Williams	City of Boulder	
Bob Harberg	City of Boulder	
Lee Rozaklis	SWMP Team	Amec
Kris Kranzush	SWMP Team	
Tracy Kosloff	SWMP Team	MWH
Barbara Lewis	SWMP Team	Catalyst
Jenny McCurdy	SWMP Team	Catalyst

If anyone from the public wishes to receive materails and notification for subsequent CSG meetings, please add you name and email address to this roster. Thank you!

CITY OF BOULDER, DEPARTMENT OF PUBLIC WORKS – UTILITIES DIVISION
SOURCE WATER MASTER PLAN
COMMUNITY STUDY GROUP MEETING #4
Meeting Minutes

FEBRUARY 28, 2008
West Boulder Senior Center, Creek Side Room
Group Members Present: See attached roster

City Utilities Division Staff Present: Ned Williams, Bob Harberg, Carol Ellinghouse, Joe Taddeucci, Kim Elkins, Bret Linenfelser

Consultants Present: Barbara Lewis, Jenny McCurdy, Lee Rozaklis, Tracy Koslof, Kris Kranzush

Public Present: Jim Knopf, WRAB Member,

I. Introductions and Welcome, Ned Williams, Asst. Director of Public Works for Utilities

Ned explained that this was the final meeting to complete the CSG efforts. He hopes the group members will advocate as the master plan moves forward through formal review.

Barbara walked through the meeting agenda and reviewed the ground rules from the CSG charter. There will be no small groups tonight, and all members need to contribute. She reminded the group that the focus of the master plan will be to identify needed studies but not to actually complete those studies as part of the plan. The staff team would like to know which of those studies the CSG feels is most important.

Joe reviewed the SWMP schedule and the schedule for remaining CSG tasks. Staff will supply WRAB with the master plan document for introduction at the April WRAB meeting. WRAB will be asked to review the plan and provide comments for the May WRAB meeting. The plan will be finalized in June, and then scheduled with the Planning Board and City Council. There are opportunities for public participation at each step.

Carter Lake Pipeline and the Carter Lake Pipeline CEAP are separate processes. Each key item or project will have a separate public process of its own, such as a CEAP, inclusion in the Capital Improvements Program, etc.

If group members want to submit written comments on the memo or recommendations table circulated for discussion tonight, they should be submitted by the end of the day tomorrow (Friday, Feb. 29). Staff will circulate a revised memo to the CSG by Friday, Mar. 7. CSG comments on that document will be due Friday, Mar. 13. The CSG memo will be finalized by Friday, Mar. 21.

Barb listed the handouts that were provided to group members at the meeting (SWMP tentative schedule, cover letter, agenda, draft CSG memo, preliminary recommendations table, final minutes for CSG meeting #1 and final minutes for CSG meeting #2). Draft minutes for CSG meeting #3 had been circulated earlier in February. There were no comments or corrections to meeting #3 minutes.

II. Strengths in Water Management

Barb asked for CSG comment on what the city of Boulder is doing well with regard to its source water system:

- The city has its studies of water availability in line.

- The city does a good job of managing the resources it has.
- The city does a good job of protecting the upper watershed.
- In addition to good management on the supply side, the city has good demand management through its water budgets and conservation plan.
- The city is proactive on climate change.
- The city does a good job of rebuilding its old infrastructure.
- The city has persisted in maintaining its existing easement from the US Forest Service for Lakewood Pipeline.
- The city does a good job of aggressively defending its water rights portfolio.

III. Draft CSG Memo Comments

Barb and Jenny asked for CSG member comments on how well substantive issues have been captured in the memo (editorial comments can be emailed or handed in) and asked if the team has represented the CSG well so far. Comments have been received from Peter Gowen and Chuck Howe. Peter appreciated how the memo captured everyone's ideas without suggesting consensus. Chuck's comments were generally positive too.

Comments included:

- The memo presents a smoothed over version. Specifically, the question concerning what guarantees the city is providing through the reliability criteria is missing. The tension is missing for some issues, e.g., regarding conservation vs. reliability, what are you getting for your conservation – water, conservation for conservation sake?
- Ninety percent of the memo presents what was presented. Only two or three pages discuss the issues and concern. It would be better to highlight what came from the CSG vs. what was presented by the project team.
- The recommendations table brings all the discussion together as a path for moving forward, and it should be presented and explained in a page or two at the front of the memo.
- Will the memo have something on risk assessment (of loss of yields) by watershed and overall? That may be in the SWMP as opposed to the memo.
- There is not sufficient information to assign probabilities to some of the risks, and that makes it difficult for decision makers.
- The tables have too much detail and are confusing and hard to read. They should go at the end of the document.
- The tables are a good way of conveying information.
- Table 2 presents a list, but a summary of the group discussions is needed.
- The memo would benefit from a brief explanation from the City Attorney's Office concerning the constraints of a water utility enterprise fund, especially pertaining to how money is spent. It would be a useful adjunct to the instream flow part of the memo, i.e., where are we with TABOR, and does it constrain uses of the water?
- The CIP provided by staff was not discussed in the last meeting and is not discussed in the memo. Seventy to eighty percent of the costs in the spreadsheet were for Carter Lake Pipeline and we did not discuss that project. (The memo talks about concepts. Projects and costs will be in the master plan document and can at that point be commented on. The handout was the 5-year CIP from last year. Staff is working with MWH to develop a 20-year CIP.)
- Will the SWMP be tied together with the Water Quality Strategic Plan? (We will make sure that the portion of the strategic plan that overlaps with the SWMP is coordinated with the SWMP.)

IV. Discussion of Major Topics

There are several topics for which discussion has not been completed, and the project team has not gotten a sense of the CSG's thoughts. The topics to be discussed are:

- Reducing reliance on West Slope supplies in the interim to buildout

- Non-municipal uses
- Use of conserved Water

Reliance on West Slope Supplies

Major points in the discussion were:

- We now bring West Slope water over to lease it. Maybe we shouldn't bring that water over.
- The interim to buildout is not a reliability issue. The issue is at buildout.
- Why are we considering reducing reliance on West Slope supplies? Is it to gain a more reliable supply? To avoid the black eye of trans-basin diversions? Both?
- Could the city be doing something else with CBT water to provide either West Slope or East Slope enhancements?
- Can CBT water be left in the Colorado River?
- If we use less West Slope water in the interim to buildout, could we do something better for the environment with it? There are major legal, political and institutional obstacles to overcome to do this. The city can't earmark its quota or dictate its use for instream flow. If the city doesn't take their water, it might not stay in the river.
- There is more potential for instream flow use of Windy Gap water. CBT water is owned by the Bureau of Reclamation.
- This isn't the first time the city has had a policy on something in which they cannot effect change. We can still express the desire to see instream flow use of CBT water.
- This shouldn't be a unilateral position statement. The downside and what values would be impacted should be examined.
- There would not be as much water to lease to Division 6 farmers. We should use caution in expressing interest in this. We are an allottee of the project.
- The three-state Platte River agreement would be affected. Colorado's contributions are based on return flows from CBT.
- It would be useful to say in the CSG memo that the discussion came up. Making this change would involve many institutional arrangements of enormous complexity, but the issue does come up a lot. There is logic to the idea, but there are many hidden issues.
- In light of the hurdles, CBT water could be used to the maximum benefit of the Front Range. For example, more water could be left in Boulder Creek if the city uses more CBT water.
- If there are long-term uncertainties with yields from CBT, do we pursue alternate West Slope arrangements or procure East Slope sources to try to come out of a shortage whole?
- Meeting demand at buildout is dependent on increased reliance on West Slope sources. We now bring the quota over. The water is already here, and the question is where it is going on the East Slope.
- The city takes one third to one half of its Windy Gap water now. The city is also not participating in projects to firm Windy Gap storage.
- Should the city expand its portfolio while it can or wait to deal with the issue later? Waiting would be more expensive.
- Do we do something sooner rather than later? If we buy additional supplies, should they come from the East Slope or West Slope? Do we jettison West Slope supplies to buy East Slope sources?
- The CBT source is just across the Divide from the Boulder Creek watershed. If West Slope sources are reduced by climate change, then Boulder Creek will also be affected.
- The city already gets the maximum CBT water it can have for municipal purposes. The city would have to consume more water to be eligible for additional municipal use CBT water.
- These are big questions that cannot be resolved this evening. We need to identify the issues first. The concern is the issues won't be dealt with until it's too late. We should not lose sight of these issues now.

- The city shouldn't do lots of expensive studies to address the issues. Others are studying what would happen if there is a Compact call. The city does however need to be at the table for these discussions.

Conserved Water

- We start taking water from storage in July. This means that we really only have more water than we need, in a good year, in May and June. Conserved water is part of our savings account for the next season. In general, we need to keep it in the savings account.

[NOTE: A discussion of non-municipal uses occurred later in the meeting and is summarized in Section VI, below.]

V. Response to Preliminary Recommendations

Staff prepared and circulated a preliminary list of recommendations to be included in the SWMP (see attached table). The group was asked for their opinions concerning the recommendations and for any additions. Which recommendations are most important to pursue?

[NOTE: Wording changes from individual group members are not included in this list, but will be reflected in the revised table.] Main points from the CSG discussion are:

- Prioritization could be approached from the bottom up. Are there any recommendations that you don't think are important? Prioritization is not meaningful if all the recommendations are important.
- The table was compiled on the basis of CSG discussions. There will be additional staff recommendations advanced in the master plan.
- The items listed in the table are not "apples-to-apples" comparisons. It's difficult to prioritize them.
- Are there items that need to be done sooner because they may provide answers to questions that are needed as a basis for near-term action? Are there others that provide information that will be needed over time?
- A stand-out issue is do we need to acquire additional water rights? These are strategic and expensive transactions which involve things outside of the city's control. It is urgent that we find a way to think about this as soon as possible.
- There has to be a commitment to the demand projection numbers.
- This is not just a question of whether Boulder grows more or not. There could be serious effects from a multi-year Compact call.
- Future water demand will most likely be less than the current buildout number. But even at the current level, impacts of some climate change scenarios could be significant. Do we want to try to insulate ourselves more than we already have? What can we control?
- What actions should be taken to help figure out if we are going to need more water, and if we do, what water sources should be pursued?
- The city could figure out the effects of new plumbing fixtures, lower demands, etc. and run that number through the model with information from the climate change study. The city could examine what happens if it doesn't have a CBT quota and what happens if we don't have one of the sources for 4 or 5 years.
- The full range of possibilities/dimensions/implications needs to be explored, especially in a decision-making process with a high degree of uncertainty.
- One question is do we want to increase reliability and how much are we willing to pay for it?
- The city's source water system is reliable now, unless there is a system failure. Should the city spend a lot of money to address something with a low probability?
- There are not a lot of options for increasing supplies. Locating something to replace the function of CBT would cost hundreds of thousands of dollars.
- These issues need to be dealt with soon and comprehensively. There is nothing to gain by waiting.

- The city could evaluate the risks to the source water system if an individual water supply has bad things happen including reduction in quality. Long-term nitrogen deposition data could be analyzed.
- There needs to be a way to resolve disputes (e.g., city and ditch companies) within our own community.
- The city needs to define why to conserve water, to what end does conserved water go, and what does the community want or not want?
- The city needs to define what reliability means. What level of water do we want to commit to specific uses, such as landscaping? The basic idea and wording of the water budget is to maintain existing landscaping. That needs to show up in the reliability. This is an urgent issue.
- The city needs to determine what the citizens think they are getting for conserving water.
- It would be useful for decision-makes to know if we are talking about new appropriations or already adjudicated rights. We need to decide if we want to take the heat for something "un-PC" or focus on already adjudicated rights.
- The recommendations need to be organized by main questions, such as, "Does Boulder have enough water?" Then recommended studies can be listed from biggest to most specific.
- If the city does acquire additional sources, it should maximize what they can be used for. New water should be made available for multiple uses.
- The city should immediately study the effects of the Eldorado Springs wastewater treatment plant to understand its effects to South Boulder Creek. Below the plant, the flow will be 100% effluent. This information could affect what kind of treatment plant they build. (The Eldorado Springs plant is to be built this year.)
- If Gross Reservoir is expanded, there is a great opportunity for the city to fill it with water. Whatever the fix is for Denver's North side (Leyden or Gross) it will take a very senior water right to make the Gross environmental pool useful.
- The city needs to use caution in what funds are used for what purposes.
- Flushing flows are needed for Main Boulder Creek, since PSCo peaking flows are no longer available. While spring flows are many times the PSCo flows, the peaking flows occurred more frequently.
- Even if Carter Lake Pipeline is built, the city should not turn its back on the Boulder Feeder Canal.
- The preliminary recommendations table captures the main items. It should be presented at the beginning of the memo.
- The recommendations table should be ordered by main questions, such as:
    - Does Boulder have enough water? What recommendations will help us decide if additional supplies are needed?
    - How should Boulder use its water?
    - How do we protect the environment?
- The city is keeping the options open for Carter Lake Pipeline, and other priorities need to also be kept in mind. Funding has been approved for the CEAP and acquisition of key rights-of-way. There will be opportunities for discussion of all individual projects in the approval process.

VI. Non-municipal Uses

The main comments concerning commitment to new non-municipal water uses were:

- Costs and impacts for instream flows need to be quantified. New instream flows should be subject to pull-backs.
- There is an implied priority concerning where excess water goes first. We can do something about instream flows, but there will always be unsatisfied demand for agricultural water.
- The current instream flow program is permanent, and it did affect reliability. Leasing is currently only on an annual basis. Should this policy be changed?

- If more water is used for instream flow, then the impacts to other uses should be considered.
- The city should commit to additional instream flows in judicious, small amounts that can be interrupted in a serious drought.
- Other city departments are not paying for the water they use. If we allocate water to Open Space, maybe Open Space should pay for it. Revenue and expense streams could be segregated to see who is paying for what.
- Some think that in the future, there will be a much higher emphasis on local farming. Lots more thinking would have to go into a decision on new non-municipal uses.
- It's probably true that instream flow has a higher value to the community than agricultural leasing, but this may be shifting. The city should maintain the ability to reconsider any decision.
- Water should be leased for agriculture only in a good year for water in May and June.
- There needs to also be a decision to either support instream flow or agriculture instead of new jobs.
- Constraints that state laws put on water utility enterprises need to be considered.

VII. Wrap-Up

In concluding the meeting, the group was asked what the Source Water Master Plan would be known for in the future. Comments were:

- For addressing the questions, "Does Boulder have enough water?" and "What do we do with it?"
- For the coalescence of the climate change issue. It is part of everything we do and the plan will represent a comprehensive way of thinking.
- For getting the city serious on deciding on growth control.
- For being the first comprehensive planning document to deal with these issues.
- For cementing the city of Boulder's commitment to multiple uses.
- For providing better input to planning decisions concerning water impacts.
- For significantly advancing the ball in this era of sustainability.
- For providing a good plan for managing and maintaining source water facilities.
- For addressing sustainability and City Council goals.

The project team members thanked the group for its involvement and input and for providing an opportunity for staff to listen to concerns and issues. The CSG thanked staff for the opportunity to participate.

Boulder Source Water Master Plan
Flipchart Notes
February 28, 2008 Community Study Group Meeting

Strengths

- City studies are in line with water supplies and availability
- Managing the resources that we have
- Good job of protecting the upper watersheds
- Good work in looking at demand side: water budget and conservation plan
- The city is proactive on climate change
- The city does a good job of re-building old infrastructure
- Lakewood pipeline isn't the Forest Service's yet!
- Aggressively defending the water portfolio.

CSG Memo Round 1 Comments

- More emphasis on what guarantees City is making to citizens using reliability criteria. What are you getting from conservation?
- Structure it to capture CSG concerns - Highlight what is higher level than reporting.
- Distinguish what came from committee vs. the team.
- Recommendation Table should bring the whole memo together. An executive summary should be developed that segues to the recommendations table
- Final memo should have information on risk assessment? (Change in yields, etc.) (in rec. studies chart) – in SWMP (Lee – not enough information to assign probabilities)
- Table 2 is confusing – should be in an appendix. Table 5
- Likes the tables
- Include the synthesis or take-home message on the table *(Jenny asks - Recommended action table?)*
- Include a city attorney's office discussion on constraints for what cand be done with ratepayer funds – specifically as it relates to using for non-municipal uses, and especially as it relates to Tabor.
- Put background information and narrative first before tables in the watershed management section
- Where do the CIP list & comments fit in? (*Will be included in the SWMP*) 70 – 80% of costs were related to the pipeline project.
- How will the Water Quality Strategic Plan be tied to the SWMP (late fall 2008 for WQSP)? Need a reference in the SWMP to connect the 2 documents.

Decreasing West Slope supplies

Advantages - None Recorded

Disadvantages

- Less Boulder Creek instream flow enhancement
- Less water to lease to District 6 water users
- Platte River Agreement relies on CBT returns

Miscellaneous comments recorded during the discussion that started out as a dialogue of the Advantages and Disadvantages of reducing reliability on West Slope supplies

- Maximize CBT use for improving instream flows in Boulder Creek
- Buildout assumes increase reliability on West Slope water (LQ)
- Should we expand our water portfolio
- Advantage of west slope acquisition vs. east slope (MA)
- Window of opportunity – Opportunities should be identified sooner than later
- Don let issue sink into a morass of paper (SP)
- Don't go it alone in evaluating climate change – (impacts to Colorado River supplies) because the state/everyone is working together on this issue. (For our own system it's OK to do so)
- Evaluated risk to system if there are disruptions/failures (from wildfires etc.)

What should the plan be known for?

- Managing and maintaining source water facilities
- Significant advancement of the ball in an era of sustainability
- Climate change
- Jobs versus farmers issue
- Need better input to our planning decisions – Tie into "calculating" planning process
- Got the city serious about deciding on source control
- This is the first *comprehensive* source water master plan
- Boulder's commitment to multiple uses is cemented
- In 20 years we could be talking about "global cooling"

Boulder Source Water Master Plan
Preliminary Recommendations

Desired Outcomes:

1. Identify where CSG as a whole concurs with preliminary recommendations
2. Identify which recommendations are most important to CSG
3. Understand CSG reservations for those items not fully endorsed

This table presents preliminary recommendations for inclusion in the BSWMP. The recommendations are organized by the four topics addressed by the CSG: water availability, non-municipal water uses, watershed management/water quality and facilities improvements in the CIP. Recommended studies and actions are based on technical analysis completed to date and the CSG's input. The column labeled "Relevance of Studies/Actions to Future Decision-Making" suggests how studies might influence future decisions. In several cases, the CSG's ideas are included as options that could be evaluated following the studies.

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
Water Availability	Reliability of water in the future	Continue to monitor developments on the Colorado River Compact; if state study is inadequate or does not occur, City moves ahead with other interested parties to conduct its own study of West Slope climate change impacts and mitigation options	Supports decision-making on interim balance between West Slope and East Slope water use and informs assumptions on West Slope source reliability for evaluations of need for any additional supplies for build-out	
		Continue climate studies and related effects on Boulder's source water and water quality, including new scenarios as appropriate given advances in GCM resolution. Evaluate potential impacts on	Potential to identify thresholds of change for responding to climate-based alteration of water yields and/or water quality for input to decisions on development of new water supplies or capital improvements	

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
		ability to capture and divert water at existing high altitude reservoirs and potential impacts to raw water quality		
		Evaluate risks to city's water system if there is an individual watershed failure or shortage as a result of climate change, localized drought, compact call, infrastructure failure or contamination event and develop a decision-making framework to determine if action should be taken to address these risks	Provides analysis by watershed of impacts to ability to deliver water in event of catastrophic event.	
		Continue efforts to protect yields of current water rights but do so in a way to preserve relationships with other entities to the extent practical	Provides guidance to City engagement in water court proceedings. May influence decisions on capital expenditures to manage supply May impact future actions by city that involve cooperation with or can be impacted by other entities	

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
	Accuracy of demand projections	Update water demand projections based on BVCP and changes in demographic/water use projections; include updated estimates of savings from federal mandates, advances in fixture manufacture and the city's water budget program and water conservation plan	Will inform decisions on water supply portfolio and municipal and non-municipal uses and support future water system modeling efforts	
	Use of conserved water	Update Water Conservation Study ▪ Define level of reliability resulting from updated demand projections, water conservation savings and supply projections ▪ Define level of increased reliability attained by exceeding current water conservation goals ▪ Ask Council if re-affirmation of current reliability criteria is desired ▪ Explore pros/cons of long-term commitment to other uses	Will inform water conservation policies, decisions on desirability of additional conservation measures and decisions about trading increased reliability for non-municipal uses as a use of conservation savings above current goal level Will establish a new buildout water demand that will be incorporated into supply model to develop new results for meeting reliability criteria	
	Future changes	Evaluate balance in	Will inform decisions on:	

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
	to the water rights portfolio	reliance on East Slope and West Slope supplies (including suggestions from CSG) Determine if changing balance in reliance on existing East/West Slope supplies will cause need for new water supplies for build-out	▪ Interruptible agricultural leases ▪ Groundwater use ▪ Acquisition of additional East Slope supplies and means of delivery to Boulder ▪ Sizing and future treatment processes of Boulder Reservoir Water Treatment Facilities ▪ Use of more CBT and Windy Gap water ▪ West Slope replacement supplies ▪ Methods to increase stream recharge ▪ Keeping Windy Gap units ▪ Repair and enhancement of storage capacity in Boulder Creek basin ▪ Continued use of Boulder's exchange rights	
Non-Municipal Uses – Instream Flows	North and Main Boulder Creeks – adequacy of flows to protect habitat under existing instream flow program with CWCB	Update aquatic habitat studies to assess effectiveness of current program and evaluate options for providing enhanced habitat to a level of detail sufficient to identify impacts, costs and benefits	Will provide input to evaluation of various measures to improve habitat, including suggestions presented in CSG memo	

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
	Middle Boulder Creek – adequacy of releases from Barker Reservoir to protect habitat	Monitoring of water rights calls and flow rates in creek to track water released by city from Barker to Orodell	Will provide input for calls to water commission to protect Barker releases in lower stream segments and decisions regarding need for formal CWCB program on Middle Boulder Creek	
	South Boulder Creek – adequate flows to protect habitat	Assist Open Space in developing a recommended approach and organizational structure to provide instream flows in South Boulder Creek and through Open Space lands to a level of detail sufficient to identify impacts, costs and benefits. Develop cooperative relationships with local ditch companies and other water rights holders, where practical.	Will provide input to: • Open Space decisions on water rights purchases for instream flow use and management of Open Space riparian lands for stream water quality protection ▪ Collaborating with South Boulder Creek water users on improving instream flows ▪ Working with Denver Water on use of Gross Reservoir environmental pool	
		Explore options for use of Utilities assets within a comprehensive program with Open Space for improved instream flows on South Boulder Creek to a level of detail sufficient to identify impacts, costs and	Will inform decisions on: ▪ Additional uses for lined Wittemyer Pond complex ▪ Use of Baseline Reservoir water released through new pipeline to South Boulder Creek for instream flow use and exchange to Gross Reservoir	

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
		benefits	▪ CBT or Windy Gap reuse water exchange to Gross Reservoir	
Non-Municipal Uses – Hydropower	Development of additional hydropower to provide more clean, renewable energy and offset water costs to customers	Evaluate environmentally and economically feasible hydroelectric sites within the water transmission system	Consideration of hydropower at: ▪ Barker Reservoir ▪ Carter Lake Pipeline discharge ▪ Other sites as may become feasible Negotiation of new power sales agreements and disposition of RECs	
Watershed Management/ Source Water Quality	Water quality and infrastructure protection through healthy forest and land use	Collaborate with other entities to prepare a community watershed wildfire protection plan	Implementation of fire risk identification and fire hazard mitigation measures as part of a comprehensive watershed protection program with Boulder County, Nederland, Eldora, USFS and others	

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
	management	Continue working with Nederland, Eldora Ski area, Boulder County, CDOT and Forest Service on Middle Boulder Creek management	Resolution of issues: ▪ WWTFs (Nederland and Eldora Ski area) ▪ BMPs for stormwater ▪ Septic systems ▪ Enforcement of animal regulations ▪ Response to Nederland's potential proposal regarding boating on Barker ▪ Potential of hazardous spill or illegal dumping in Middle Boulder Creek watershed upstream of Nederalnd	
	Wildfire contingency	Complete source water emergency plan	▪ Timely implementation of emergency response ▪ Decisions on most effective wildfire recovery methods for watersheds	
	Source water quality to Boulder Reservoir Water Treatment Facility	Implement measures to improve water quality and security vulnerability along the Boulder Feeder Canal and in the Boulder Reservoir basin	▪ Certain measures have been identified and additional measures may be needed depending on the outcome of the decision regarding the Carter Lake Pipeline NOTE REWORD ABOVE SENTENCE AND ADD A NOTATION ABOUT CONTINUED NEED FOR PROTECTION OF BFC EVEN IF CLP IS CONSTRUCTED	

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
			DUE TO REC USE AT RESERVOIR AND DOWNSTREAM USERS	
Facilities Improvement & CIP	Infrastructure maintenance/ development	Continue Carter Lake Pipeline CEAP and currently approved ROW acquisition and permitting	▪ Will inform decision on if/when to build Carter Lake Pipeline	
		Develop a 20-year CIP with a comprehensive list of needs and projects	▪ Optimize timing for facility improvements to provide system reliability, water quality protection and safety and minimize impacts to water rates, including: o Prioritizing improvements to Barker system o Prioritizing improvements to watershed dams o Prioritizing improvements to Boulder Reservoir WTP facility source water quality	

Boulder Source Water Master Plan
Preliminary Recommendations

Desired Outcomes:

4. Identify where CSG as a whole concurs with preliminary recommendations
5. Identify which recommendations are most important to CSG
6. Understand CSG reservations for those items not fully endorsed

This table presents preliminary recommendations for inclusion in the BSWMP. The recommendations are organized by the four topics addressed by the CSG: water availability, non-municipal water uses, watershed management/water quality and facilities improvements in the CIP. Recommended studies and actions are based on technical analysis completed to date and the CSG's input. The column labeled "Relevance of Studies/Actions to Future Decision-Making" suggests how studies might influence future decisions. In several cases, the CSG's ideas are included as options that could be evaluated following the studies.

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
Water Availability	Reliability of water in the future	Continue to monitor developments on the Colorado River Compact; if state study is inadequate or does not occur, City moves ahead with its own study of West Slope climate change impacts and mitigation options	Supports decision-making on interim balance between West Slope and East Slope water use and informs assumptions on West Slope source reliability for evaluations of need for any additional supplies for build-out	
		Continue climate studies and related effects on Boulder's source water, including new scenarios as appropriate given advances in GCM resolution	Potential to identify thresholds of change for responding to climate-based alteration of water yields for input to decisions on development of new water supplies or capital improvements	
		Continue efforts to protect yields of current	Provides guidance to City engagement in water court	When do the city's efforts to protect rights become

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
		water rights	proceedings. May influence decisions on capital expenditures to manage supply	predatory? Numerous ditch companies and citizens have been adversely affected by city water policies. Do we need community oversight for dispute resolution?
	Accuracy of demand projections	Update water demand projections based on BVCP and changes in demographic/water use projections; include updated estimates of savings from federal mandates, advances in fixture manufacture and the city's water budget program	Will inform decisions on water supply portfolio and municipal and non-municipal uses and support future water system modeling efforts	
	Use of conserved water	Update Water Conservation Study ▪ Define level of reliability resulting from updated demand projections, water conservation savings and supply projections ▪ Define level of increased reliability attained by exceeding current water conservation goals ▪ Ask Council if re-	Will inform water conservation policies, decisions on desirability of additional conservation measures and decisions about trading increased reliability for non-municipal uses as a use of conservation savings above current goal level	**Our citizens believe they are receiving environmental benefit from their water conservation. What is that environmental benefit?** **We need new policy discussions in this area. We have energy credits, why not water credits?**

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
		affirmation of current reliability criteria is desired ▪ Explore pros/cons of long-term commitment to other uses		
	Future changes to the water rights portfolio	Evaluate balance in reliance on East Slope and West Slope supplies (including suggestions from CSG) Determine if changing balance in reliance on existing East/West Slope supplies will cause need for new water supplies for build-out	Will inform decisions on: ▪ Interruptible agricultural leases ▪ Groundwater use ▪ Acquisition of additional East Slope supplies and means of delivery to Boulder ▪ Sizing of Boulder Reservoir Water Treatment Facilities ▪ Use of more CBT and Windy Gap water ▪ West Slope replacement supplies ▪ Methods to increase stream recharge ▪ Keeping Windy Gap units ▪ Repair and enhancement of storage capacity in Boulder Creek basin ▪ Continued use of Boulder's exchange rights	
Non-Municipal Uses – Instream Flows	North and Main Boulder Creeks – adequacy of flows to protect	Update aquatic habitat studies to assess effectiveness of current program and evaluate	Will provide input to evaluation of various measures to improve habitat, including suggestions	Studies must include flushing flow regiments for reduced sediment impaction.

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
	habitat under existing instream flow program with CWCB	options for providing enhanced habitat to a level of detail sufficient to identify impacts, costs and benefits	presented in CSG memo	Macroinvertabrate studies need to be conducted in conjunction with water quality data.
	Middle Boulder Creek – adequacy of releases from Barker Reservoir to protect habitat	Monitoring of water rights calls and flow rates in creek to track water released by city from Barker to Orodell	Will provide input for calls to water commission to protect Barker releases in lower stream segments and decisions regarding need for formal CWCB program on Middle Boulder Creek	
	South Boulder Creek – adequate flows to protect habitat	Assist Open Space in developing a recommended approach and organizational structure to provide instream flows in South Boulder Creek and through Open Space lands to a level of detail sufficient to identify impacts, costs and benefits	Will provide input to: • Open Space decisions on water rights purchases for instream flow use and management of Open Space riparian lands for stream water quality protection ▪ Collaborating with South Boulder Creek water users on improving instream flows ▪ Working with Denver Water on use of Gross Reservoir environmental pool	Please refer to the 12-06 memo from Ned Williams outlying the priorities for improved South Boulder Creek in-stream flows. This issue has been studied for the past four years and we are ready for **real** policy discussions and funding options with WRAB and City Council.
		Explore options for use of Utilities assets within a comprehensive program with Open Space for improved instream flows on South Boulder Creek	Will inform decisions on: ▪ Additional uses for lined Wittemyer Pond complex ▪ Use of Baseline Reservoir water released through new pipeline to South	See Above.

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
		to a level of detail sufficient to identify impacts, costs and benefits	Boulder Creek for instream flow use and exchange to Gross Reservoir ▪ CBT or Windy Gap reuse water exchange to Gross Reservoir	
Non-Municipal Uses – Hydropower	Development of additional hydropower to provide more clean, renewable energy and offset water costs to customers	Evaluate environmentally and economically feasible hydroelectric sites within the water transmission system	Consideration of hydropower at: ▪ Barker Reservoir ▪ Carter Lake Pipeline discharge ▪ Other sites as may become feasible Negotiation of new power sales agreements and disposition of RECs	
Watershed Management/ Source Water Quality	Water quality and infrastructure protection through healthy forest and land use management	Collaborate with other entities to prepare a community watershed wildfire protection plan	Implementation of fire risk identification and fire hazard mitigation measures as part of a comprehensive watershed protection program with Boulder County, Nederland, Eldora, USFS and others	**An immediate study of the effects of Eldorado Springs effluent WTP flows in South Boulder Creek is critical. Current winter flows of 2-3 cfs or less mixed with new effluent will be a habitat disaster.**

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
		Continue working with Nederland on Middle Boulder Creek management	Resolution of issues: ▪ WWTF ▪ BMPs for stormwater ▪ Septic systems ▪ Enforcement of animal regulations ▪ Response to Nederland's potential proposal regarding boating on Barker	Bypassing Barker and putting Nederland effluent flows directly to Boulder Creek is an unacceptable option.
	Wildfire contingency	Complete source water emergency plan	▪ Timely implementation of emergency response ▪ Decisions on most effective wildfire recovery methods for watersheds	
	Source water quality to Boulder Reservoir Water Treatment Facility	Implement measures to improve water quality and security vulnerability along the Boulder Feeder Canal and in the Boulder Reservoir basin	▪ Certain measures have been identified and additional measures may be needed depending on the outcome of the decision regarding the Carter Lake Pipeline	Certain measures should be implemented regardless of the outcome of the Carter Lake Pipeline decision. (ie: improved drainage from roadways and other drainage sources averting flows into the canal)
Facilities Improvement & CIP	Infrastructure maintenance/ development	Continue Carter Lake Pipeline CEAP and currently approved ROW acquisition and permitting	▪ Will inform decision on if/when to build Carter Lake Pipeline	**I do not support this issue. It has already been determined not to be a high priority by the WRAB. I support their decision.**
		Develop a 20-year CIP with a comprehensive list	▪ Optimize timing for facility improvements to provide	The 20 year CIP list should include all

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
		of needs and projects	system reliability, water quality protection and safety and minimize impacts to water rates, including: o Prioritizing improvements to Barker system o Prioritizing improvements to watershed dams o Prioritizing improvements to Boulder Reservoir WTP facility source water quality	projects, not just water delivery and treatment systems. Your list does not contain any of the recommended non-municipal projects detailed earlier.

Some comments from Bart Miller

Boulder Source Water Master Plan
Preliminary Recommendations

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Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
Water Availability	Reliability of water in the future	Continue to monitor developments on the Colorado River Compact; if state study is inadequate or does not occur, City moves ahead with its own study of West Slope climate change impacts and mitigation options	Supports decision-making on interim balance between West Slope and East Slope water use and informs assumptions on West Slope source reliability for evaluations of need for any additional supplies for build-out to inform decisions	Boulder should not do its own West Slope study; but maybe collaborate
	if we have basics, then act now	Continue climate studies and related effects on Boulder's source water, including new scenarios as appropriate given advances in GCM resolution	Potential to identify thresholds of change for responding to climate-based alteration of water yields for input to decisions on development of new water supplies or capital improvements	
		Continue efforts to protect yields of current water rights	Provides guidance to City engagement in water court proceedings. May influence decisions on capital expenditures to manage supply	

Decrease reliance on W. Slope water →

Pro: lower energy costs, dedicate to Colorado River (unlikely)
Con: lose exchange potential,

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
	Accuracy of demand projections	Update water demand projections based on BVCP and changes in demographic/water use projections; include updated estimates of savings from federal mandates, advances in fixture manufacture and the city's water budget program	Will inform decisions on water supply portfolio and municipal and non-municipal uses and support future water system modeling efforts	
	Use of conserved water	Update Water Conservation Study ▪ Define level of reliability resulting from updated demand projections, water conservation savings and supply projections ▪ Define level of increased reliability attained by exceeding current water conservation goals ▪ Ask Council if re-affirmation of current reliability criteria is desired ▪ Explore pros/cons of long-term commitment to other uses	Will inform water conservation policies, decisions on desirability of additional conservation measures and decisions about trading increased reliability for non-municipal uses as a use of conservation savings above current goal level	We can/should use more of our supply to improve stream flow in main & S. Bldr Creek high priority as it will inform other decisions This should be permanent dedication to flow a like CWCB instream right not just use of surplus
	Future changes to the water rights portfolio	Evaluate balance in reliance on East Slope and West Slope supplies (including suggestions from CSG) Determine if changing balance in reliance on existing East/West Slope supplies will cause need for	Will inform decisions on: ▪ Interruptible agricultural leases ▪ Groundwater use ▪ Acquisition of additional East Slope supplies and means of delivery to Boulder ▪ Sizing of Boulder Reservoir Water Treatment Facilities ▪ Use of more CBT and Windy	

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
		new water supplies for build-out	Gap water ▪ West Slope replacement supplies ▪ Methods to increase stream recharge ▪ Keeping Windy Gap units ▪ Repair and enhancement of storage capacity in Boulder Creek basin ▪ Continued use of Boulder's exchange rights	
Non-Municipal Uses – Instream Flows	North and Main Boulder Creeks – adequacy of flows to protect habitat under existing instream flow program with CWCB	Update aquatic habitat studies to assess effectiveness of current program and evaluate options for providing enhanced habitat to a level of detail sufficient to identify impacts, costs and benefits	Will provide input to evaluation of various measures to improve habitat, including suggestions presented in CSG memo	if new water acquired Boulder should maximize it to meet many use, especially instream, in permanent dedication
	Middle Boulder Creek – adequacy of releases from Barker Reservoir to protect habitat	Monitoring of water rights calls and flow rates in creek to track water released by city from Barker to Orodell	Will provide input for calls to water commission to protect Barker releases in lower stream segments and decisions regarding need for formal CWCB program on Middle Boulder Creek	" ↓ "
	South Boulder Creek – adequate flows to protect habitat	Assist Open Space in developing a recommended approach and organizational structure to provide instream flows in South Boulder Creek and through Open Space lands to a level of detail sufficient to identify impacts, costs and benefits	Will provide input to: • Open Space decisions on water rights purchases for instream flow use and management of Open Space riparian lands for stream water quality protection ▪ Collaborating with South Boulder Creek water users on improving instream flows	" ↓ "

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
			▪ Working with Denver Water on use of Gross Reservoir environmental pool	Need to leverage Gross Reservoir expansion result in real water in S. Bldr environmental pool
		Explore options for use of Utilities assets within a comprehensive program with Open Space for improved instream flows on South Boulder Creek to a level of detail sufficient to identify impacts, costs and benefits	Will inform decisions on: ▪ Additional uses for lined Wittemyer Pond complex ▪ Use of Baseline Reservoir water released through new pipeline to South Boulder Creek for instream flow use and exchange to Gross Reservoir ▪ CBT or Windy Gap reuse water exchange to Gross Reservoir	
Non-Municipal Uses – Hydropower	Development of additional hydropower to provide more clean, renewable energy and offset water costs to customers	Evaluate environmentally and economically feasible hydroelectric sites within the water transmission system	Consideration of hydropower at: ▪ Barker Reservoir ▪ Carter Lake Pipeline discharge ▪ Other sites as may become feasible Negotiation of new power sales agreements and disposition of RECs	
Watershed Management/ Source Water Quality	Water quality and infrastructure protection through healthy forest and land use management	Collaborate with other entities to prepare a community watershed wildfire protection plan	Implementation of fire risk identification and fire hazard mitigation measures as part of a comprehensive watershed protection program with Boulder County, Nederland, Eldora, USFS and others	

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
		Continue working with Nederland on Middle Boulder Creek management	Resolution of issues: ▪ WWTF ▪ BMPs for stormwater ▪ Septic systems ▪ Enforcement of animal regulations ▪ Response to Nederland's potential proposal regarding boating on Barker	
	Wildfire contingency	Complete source water emergency plan	▪ Timely implementation of emergency response ▪ Decisions on most effective wildfire recovery methods for watersheds	
	Source water quality to Boulder Reservoir Water Treatment Facility	Implement measures to improve water quality and security vulnerability along the Boulder Feeder Canal and in the Boulder Reservoir basin	▪ Certain measures have been identified and additional measures may be needed depending on the outcome of the decision regarding the Carter Lake Pipeline	Not much needed if pipeline goes forward
Facilities Improvement & CIP	Infrastructure maintenance/ development	Continue Carter Lake Pipeline CEAP and currently approved ROW acquisition and permitting	▪ Will inform decision on if/when to build Carter Lake Pipeline	
		Develop a 20-year CIP with a comprehensive list of needs and projects	▪ Optimize timing for facility improvements to provide system reliability, water quality protection and safety and minimize impacts to water rates, including: o Prioritizing improvements to Barker system o Prioritizing improvements to	

Category	Issue	Recommended Studies and Actions	Relevance of Studies/Actions to Future Decision-Making	Comments
			watershed dams o Prioritizing improvements to Boulder Reservoir WTP facility source water quality	

* What to do with "conserved" water?

We start pulling water from storage in July. This means that we really only have more water than we need, in a good year, in May and June. Conserved water is part of our savings account for the next season. In general, we need to keep it in the ~~[illegible]~~ savings account

Ken Wilson

* Should we commit water to non-municipal uses?

For ag — only in a good year for water in May and June

For instream flow — Judicious, small amounts that can be interrupted in a serious ~~[illegible]~~ drought.

Ken Wilson

Appendix B

STAFF SURVEY SUMMARY

Executive Summary
City of Boulder
Source Water Master Plan Staff Survey Responses
December 2007

There were 49 respondents to the Source Water Master Plan survey from different divisions and departments within the city. Staff were asked to identify the "top 3 to 5" most urgent needs within the city's source water system. Responses to that question are listed in the attached table. The two most commonly mentioned, high priority capital improvements were:

- Construction of Carter Lake Pipeline to protect water quality and address the security/vulnerability of Boulder's Colorado-Big Thompson and Windy Gap water sources and;
- Rehabilitation of the Barker Gravity Pipeline due to its age, poor condition and critical position in Boulder's water supply system.

Other high priority projects included:

- Boulder Reservoir management plan and BMPs along Boulder Feeder Canal;
- Improvements to security and vulnerability at Kossler Reservoir;
- Boulder Canyon Hydro improvements, and;
- Repairs to Lakewood Pipeline.

Common Themes

Many facilities are old and will likely need partial replacement or modernization in the next 10 years.

Water resources planning and the status of water rights are generally considered to be good. The instream flow program could be evaluated and formalized in cooperation with other entities such as Boulder County. Several comments involved improvements to upper Boulder Creek watershed storage facilities such as improvements to Silver Lake Dam outlet works and repair of Green Lake #2 Dam.

The security and vulnerability of facilities were frequently mentioned by staff along with the following ideas:

- Staff are needed to patrol facilities;
- Capital improvements are needed for security, and;
- Security upgrades could potentially be combined with remote monitoring, recording, and operation capabilities for outlying facilities.

Overall, facilities maintenance has improved in the last decade. There is still room for improvement and a need for more funding and training for maintenance staff. Maintenance planning, scheduling, and documentation should be improved.

Detailed responses were received regarding particular needs for most of Boulder's source water facilities. These responses will be documented in the SWMP.

Source Water Projects Listed as "Top 3 to 5" Most Urgent by Group

Project	Water Quality / Water Treatment	Utilities Project Engineering	Water Resources	CAO / CMO / Util Admin	OSMP / P&R
Boulder Feeder Canal Security & Water Quality / Carter Lake Pipeline	11	2	2		
Barker Gravity Line Repair	3	3	2		
Boulder Reservoir Plan & BMPs	4	1			
Kossler Reservoir Security & Vulnerability	2	1			
Improve Boulder Canyon Hydro	1	1	1		
Repair Lakewood Pipeline	1	1	1		
Wastewater & Septic Tanks Affecting Barker	2				
Move Barker Caretaker Residence			1		
Barker Dam Rehab	1				
Repair Green Lake #2		1	1		
Line Wittemyer Ponds			1		
Silver Lake Dam Outlet Works Improvements		1			
Lakewood Reservoir Dam Assessment/Improvements		1			
Kossler Reservoir Dam, Valving and Intake Improvements	1	1			
N. Boulder Creek Water Quality Protection	1				
Ordinance specifically requiring Silver Lake Watershed Closure	1				
Clarify Silver Lake Reservoir Ownership				1	
Rehab / Expansion of Existing Watershed Reservoirs				1	
Energy efficiency & production via hydropower				1	
Retention of RECs				1	
Diligent management of easements				1	
Instream Flows on S. Boulder Creek					1
Better Control & Distribution of Water Pressure					1
Improve Water Portfolio to Address Growth & Climate Change				1	

Note: The Water Quality & Water Treatment work groups provided additional responses to the survey that are not included here. Responses related to treatment plant needs are not included, since these needs are addressed through the treated water master planning process.

Detailed Summary

The survey responses are summarized below. Some responses have been combined to avoid repetition. In some cases, survey respondents were contacted to provide additional explanation. Key words are highlighted in blue text.

Sections include:

A) Facilities Condition
B) Operations, Maintenance, and Staffing
C) Water Rights Yields and Storage
D) Water Use
E) Watershed / Land Management / Source Water Quality Protection

A. Facilities Condition

North Boulder Creek Facilities

Green Lake #1 has an inoperable outlet valve.

Green Lake #2 has a filling restriction due to structural damage.

There is seepage from Albion dam and spalling on the downstream face of the dam. This is not structural damage; it could be repaired with grout or membrane Albion Reservoir needs a gage.

There is spalled concrete on the Island Lake splash wall. It could be repaired with grout or by replacing the concrete).

The Silver Lake Dam outlet valves should be evaluated to determine their condition and possibly repaired / updated.

Silver Lake Hydro needs a SCADA upgrade and the PLCs should be changed to the same type as water treatment plants have.

The Silver Lake Diversion (North Boulder Creek diversion into Silver Lake Pipeline) ices at night in the winter and the pressure transducer for flow doesn't work, The instrumentation needs better protection from the environment (there is potential for a small wind turbine or other back-up for solar heaters). Larger storage capacity would provide a cushion for hydro operations when there isn't any water for hydro and would hold debris.

The Silver Lake caretaker residence and bunkhouse need new metal roofs.

The North Boulder Creek diversion to Lakewood Reservoir and pressure transducer for flow ice up sometimes.

The Lakewood Reservoir outlet works have been redone, but the dam's structure/condition may need to be assessed. Lakewood Reservoir has limited security. It could use cameras on the hydro

building doors and pipe inlet. The reservoir inlet to Lakewood Pipeline is located near the shore, and water quality can be affected by shoreline influences such as storm runoff. The volume is not large enough to allow for settling after storm events and spring runoff or dilution for security purposes. It could be dredged for more capacity.

Como Creek can cause high turbidity and other water quality issues in the Lakewood system. Earlier this year, water was being diverted from Como Creek when a private landowner unexpectedly was using heavy equipment in the pond system thus releasing very highly turbid water that was then taken into Lakewood Reservoir. Historical mines may also affect the quality of this source. The North Boulder Creek and Como Creek diversion structures do not provide enough flexibility to deal with upstream effects. It also shows the great importance of notification of the city by that land owner whenever a planned activity could impact the city's source water.

The management plan for Caribou Ranch doesn't sufficiently protect water quality entering Lakewood Reservoir (inadequate mitigation identified, insufficient forecasting and planning). Source water quality issues could potentially worsen with future development and recreation uses. The city needs to monitor its easements to ensure protection of source water, continue to coordinate with the county and monitor pest management techniques and use of chemicals.

Lakewood Pipeline substandard welds and ongoing monitoring needs are concerns. Communication of inspection results to staff could be helpful in terms of confidence in the system. It may be necessary to reline and rebuild parts of the pipeline. Also, there are issues with the flow meter on the downstream (Betasso) side and communication problems / discrepancy between two flow meters. There is therefore no reliable way to determine minor leaks.

Middle Boulder Creek / Barker

The Skyscraper Reservoir outlet valve is inoperable and has a seepage problem Repairs might be made with a membrane on the upstream face of the dam or grout.

Barker Reservoir has a plan in place to manage and improve supply. The outlet works need an overhaul along with provisions for remote operation and monitoring capability. This could potentially be implemented for the hydro plant too. The city should add capability to record flow rates through Barker Gravity Line and into Boulder Creek. Work on the Barker water system should be implemented as defined in the 2008-2013 CIP.

There are several water quality concerns:

- Receiving Nederland's wastewater will become more of a problem with emerging contaminants becoming of more importance. Possible solutions are to move the outfall downstream of the Barker Gravity Line inlet or improve the wastewater treatment plant. A Lewis study showed that effluent can short circuit to the Barker Gravity Line under certain conditions. Pathogen and nutrient removal upgrades are planned.
- Urban runoff from Nederland could be a problem, and there were several suggestions for improvement of facilities surrounding the reservoir. The city doesn't own the land around Barker Reservoir, so better coordination with Nederland regarding source water protection, such as intergovernmental agreement(s) and/or a watershed manager, is needed. A desire was expressed to develop some facilities at the west end of Barker consistent with Nederland's

downtown redevelopment goals. The new Nederland skate park/facilities have been a good change.

- There is a potential for contamination from septic systems..
- Security is poor.
- The caretaker's house is too far from the dam. Rent should be eliminated.

The 100-year-old Barker Gravity Pipeline is in poor condition and has a high potential for failure which could limit supplies during critical times. The entire length should be replaced, except for those sections that were recently replaced. The pipeline could use a leak detection system. Access points are not secure.

The intake from Kossler Reservoir to Boulder Canyon Penstock is in poor condition and is a vulnerable access point. The dam needs refacing. It's heavily damaged from freeze/thawing. The small reservoir volume is not sufficient for settling or dilution of contaminants from the watershed or an attack, and there is no way for source water to bypass the reservoir if it is contaminated.

Boulder Canyon Hydro is very old, inefficient, not up to modern standards, and could be considered dangerous. A unit could be replaced when the B unit is retired in 2009-10. Eventual replacement of one of the units with a modern hydroelectric unit could have benefits in greater power production and improved safety. A bypass valve is needed to continue to release instream flows during hydro outages. Exemption from FERC permitting is being pursued.

A section of the Betasso Penstock from Boulder Canyon Penstock to Betasso Hydro is in the process of being replaced. This will resolve its inadequate small size and resulting hydro generation limitations.

Boulder Reservoir System

Boulder Reservoir needs plans for recreation management, wildlife, weed management, bank stabilization, and invasive species (boat washing station). Planning should be coordinated with Parks and Recreation and the Boulder Reservoir Watershed Management Group. Boulder Reservoir source water can have taste and odor issues (low DO, manganese) and requires more chemicals for treatment than water from the Boulder Feeder Canal. Boulder Reservoir is not designed or sited well for drinking water supply due to poor soils, shallow depth, large surface area and increasing recreation use. The land surrounding the reservoir is not managed by the Utilities Division.

Boulder Feeder Canal has numerous water quality issues because it is open, and there were many suggestions to supplement the canal with a pipeline (discussed in more detail in the Water Quality section, below) or a partial pipeline (under roadways, to protect from outfalls and to eliminate access for recreational activities). Source water concerns include algae, weeds, turbidity, contaminated runoff into the canal and security. The diversion structure to the water treatment plant cannot always meet demands at the WTP and gets clogged with weeds. NCWCD deliveries are getting more and more variable as fewer farmers are calling for water. The city should work with NCWCD to discontinue pesticide use on the canal banks and adjoining properties. Stormwater BMPs should be installed.

Farmers Ditch does not have enough capacity for Utilities to get its share. Suggestions to line the canal, put in pipe and limit ditch users to their share were made. It could also be a security risk, but it does have the benefit of providing for dilution in Boulder Reservoir.

B. Operations, Maintenance, and Staffing

Utilities is moving from a reactive mode to a proactive maintenance mode gradually as facilities have been updated and fewer demands are placed on staff for keeping up with the maintenance backlog from old facilities. The city still seems to be lacking resources in terms of people, training and tools to really be following a maintenance plan similar to a car's maintenance schedule. Most facilities are informally inspected. More documentation of formal inspections could be provided. Hydro facilities have a plan for regular maintenance, but other facilities may not. The city should develop standard operating procedures for all facilities. A raw water pipe inspection program is needed.

Maintenance staff is underpaid and undertrained, which affects the quality of personnel that can be retained. The city needs experienced and well-trained technical staff who can maintain the more technical equipment and computer systems that have been and are being added to the system. In order to retain experienced technical staff, the city needs to meet industry-wide salaries and benefits. Staff with daily interaction with facilities know what problems are developing, but information is not always conveyed to others so adequate budgets can be developed.

It is not clear which group is responsible for "stranded facilities" like air relief vaults and the raw water fire systems.

Facilities could be improved to allow remote operation and monitoring. All facilities should be considered from this standpoint. There are communication needs including fiber back-up for Betasso WTP to some hydros and reservoirs to increase reliable operations and security. A means to identifying leaks in Lakewood Pipeline is needed.

The city should look into software to help track maintenance schedules and activities and look into outside help to manage and do the maintenance. A consultant(s) to help coordinate maintenance and a contractor(s) to help get it done may be needed. The city should prepare a formal annual report based on inspection of facilities condition. The report could be used to support a scheduled maintenance program.

Federal regulations, climate change, and population increase all result in an increased burden on existing Utilities Staff. The water resources and water quality groups may be understaffed. The water resources group's responsibilities will only be increasing with global warming and increased federal treatment requirements. Water resources could use administrative support in the areas of document production and basic project support. There should be a point person within the city for coordination with Northern Colorado Water Conservancy District concerning Carter Lake Pipeline and interim management of Boulder Feeder Canal. Another water resources specialist and/or project manager may be needed to deal with increased water accounting needs, on-going maintenance tracking, and increased public interest in water supplies. Another full time employee may be needed (move from 1 to 2) for the conservation program.

A Utilities GIS person who is able to focus on utility GIS analysis and mapping is needed. GIS data on creeks and ditches should be updated and merged with OSMP files, which are maintained separately.

C) Water Rights Yields and Storage

The city generally has sufficient water for build-out conditions (assuming there is low growth potential in the service area), but drought and climate change result in some uncertainty. The city is on the cutting edge in terms of climate change planning, working with NOAA and Hydrosphere. Some staff are not familiar with the city's efforts regarding drought protection and climate change simulation.

The reliability criteria are adequate, but the city needs to make them easier to convey and understand.

The city needs to increase storage space in the upper watershed. The Green Lake No. 2 dam restriction reduces water supply storage.

Wittemyer Ponds could be lined for storage of reusable water.

The technical, biological basis for supporting instream flow in Boulder Creek is not clear. Since the instream flow water rights were established before the city purchased Barker, an update of the biological evaluation seems appropriate. This would help to determine if instream rights are addressing the correct aquatic ecosystem goals and support adjusting or maintaining the currently dedicated instream flow rights. The instream flow program on North and Middle Boulder Creeks is not fully developed. Utilities should coordinate with OSMP, Parks and Recreation, and the community in continuing to develop goals and formalizing the instream flow program. The city should work with the state to reestablish the gaging station at Sherwood Creek because it is difficult to estimate flows below Lakewood Reservoir for the instream flow program in North Boulder Creek. Some of the existing gaging devices around Lakewood Reservoir don't measure flow well below 1 or 2 cfs. The city should do additional fisheries studies to document improvements from the North and Middle Boulder Creek instream flow programs.

Instream flow water rights for South Boulder Creek should be considered. This might be challenging given that Utilities' water rights are on Boulder Creek. The city should consider expansion of Gross Reservoir and coordinate with Louisville, Lafayette, Denver Water and CDOT as US Highway 36 improvements go forward. A South Boulder Creek management group should be established. OSMP should lead effort on South Boulder Creek.

The city needs to make conditional water rights (Windy Gap) absolute. The city should use North Boulder Farmers and Lower Boulder rights to make the exchange absolute. The city should use the 1999 Barker storage right and make it absolute. The city should store more water in Boulder Reservoir.

The city should decide if the Park Reservoir site will be necessary for future municipal water supply or not. The city could potentially pursue a land trade with USFS for Barker Gravity Line land or pursue selling it to the county to create contiguous open space.

An increase in capacity of Farmer's Ditch to carry city foreign water, lining of the ditch and regulation of ditch users to limit them to their share should be considered.

The Silver Lake Reservoir / Silver Lake Ditch company dispute should be resolved.

D) Water Use

The city needs to identify a contractual or institutional method for maintaining irrigation ditches within the context of their varied ownerships with ditch riders retiring. There could be issues with safety, water loss and potential flooding/piping. The city should consider lining ditches to increase conveyance capacity.

Legal and illegal discharges to ditches occur. There may be a need to reconfigure some drainages if unwanted discharges and stormwater are entering source water ditches. Trash racks and various grates, railings, fences etc. may be necessary safety elements where ditches run through publicly accessible land.

Anderson Ditch needs improvements.

Parks and Recreation would like to utilize raw water irrigation in more parks, but delivery systems are not in place for many parks. The complex pumps required to deliver the water and the technical, costly maintenance requirements are challenging for Parks and Recreation. Moisture sensors should be integrated with the raw water irrigation systems. Current funding is not adequate for maintaining or expanding the raw water system. Troubleshooting should be done on a cyclical basis, but funding is not available. The water utility may have the expertise to help in design, installation, and maintenance for the city's park pumping system. The city should explore the idea of a raw water utility for large irrigation users.

The city should identify remaining park sites that are suitable for raw water irrigation and pursue implementation. Stazio Ballfields could be converted to raw water irrigation if Jones and Donnelly Ditch water rights are purchased. Also, Pleasant View Soccer Fields and Elks Club park could get supplemental Farmers Ditch water.

Over the past two years, Parks managers have not been able to get monthly water use reports relevant to metered parkland. In the past, these reports were a very useful tool in our efforts to be efficient, effective and conservative in our park water use efforts.

The current hydro program is good but could do more. Energy efficiency and production could be improved. The revenue that hydros produce should go back into the hydro system for updates and operator education and training. Monthly hydro tests to earn capacity payments from Xcel compromise water treatment and stress the distribution system. It is paramount that we retain ownership of the Renewable Energy Credits (RECs) in the future as the contracts for the hydro facilities with Xcel come up for renewal. Instream flows need to be balanced with hydro needs.

Boulder's conservation program is probably the best in the State of Colorado, with the rebate program, specific water budgets based on irrigable areas and city residents who possess a good conservation ethic. Conservation education should stress the real gains of water conservation, which (without more storage) is longevity of facilities, drought protection, and instream flows (also more stored water during certain times of year). The conservation program should support

more sustainable landscapes, not turf (should coordinate with Parks, Forestry, Office of Environmental Affairs, FAM and Planning & Development Services in these discussions). We absolutely need to require, not just encourage, water conservation. The habit of conservation is the most responsible method for achieving water conservation.

There is a need to work more with the irrigation community to help them understand the new water budget rate structure (which can be confusing) and ways that they can improve their water use efficiency. The city could try to reach small to mid-size businesses with water audits. There have been complaints that water audits don't provide useful information. Water conservation staff could develop specific projects to implement and have consistent communication with other city staff. Water conservation staff could work with Planning and Development Services and Parks to implement conservation goals.

The water conservation plan should be updated every 2 to 5 years to reflect the new water budget rate structure and incorporate anything else new.

Drought planning is good, but Parks and Recreation should have a plan for which areas should be cut off of water first in a drought.

The city doesn't have any policy on dewatering for residential development. The effect of this has been to reduce the groundwater table in some areas with wells or seepage water rights. The indirect effect has been to lose some wetlands (specifically in the Norwood/19th St. area).

E) Watershed / Land Management / Source Water Quality Protection

Internal source water quality protection goals need to be clearly defined, communicated broadly and reviewed and revised at least annually. A precautionary principle in the Boulder Valley Comprehensive plan is needed to protect water quality and security of supplies. Additional support from city management may be needed to more strictly enforce the source water protection program.

The utility has inconsistent public access and management policies (no access in Silver Lake Watershed and contact recreation in Boulder Reservoir).

Keep Silver Lake Watershed closed, through an ordinance that addresses this land specifically, not just Utilities property.

The utility should have management and planning documents for all properties owned. Utilities should consider hiring an integrated pest management (IPM) coordinator to manage Utilities' owned land. A full time IPM coordinator could develop projects year-round and manage the temporary Greenways Crew. Continuity of having a year-round coordinator rather than a temporary crew leader will lead to more effective management of Utilities properties

The city could benefit from more interaction with the Boulder Creek watershed initiative. Speakers from the utility could reach interested members of the public at the forums.

The Boulder County Health Department should tighten septic system regulations. Jefferson County is a good model.

More coordination with Parks and Recreation is needed for implementing stormwater BMPs in locations tributary to the source water system.

Wildfire poses a risk for water quality which is compounded with beetle kill. A plan for beetle kill should be in place. Define the wildfire risk in the Silver Lake Watershed. Reduce wildfire risk in the watershed above Barker Reservoir. Protocols for security and water quality at Kossler Reservoir should be developed with the fire district. The city should cut trees around pipelines to reduce wildfire risk. The city should coordinate with USFS, Colorado State FS, and Boulder County concerning wildfire risk reduction.

Additional funds are needed to enhance security of source waters. This includes capital costs for equipment and possibly new staff to address security issues and do patrols. The city should consider a full time security staff that, in part, would focus on source water security. An inspection/maintenance/security crew is needed for all water pipes and the related equipment on them. The city needs to develop a notification process and emergency response protocols.