

**TO:** Mayor and Members of City Council

**FROM:** Ned Williams, Director of Public Works for Utilities  
Bob Harberg, Utilities Planning and Project Management Coordinator

**DATE:** July 20, 2007

**SUBJECT:** Supplemental Information about the Carter Lake Pipeline Project for the CIP Study Session on July 31, 2007

Attached is a copy of the agenda item memo from the June 28, 2007 Water Resources Advisory Board (WRAB) meeting regarding the Integrated Evaluation of the Boulder Reservoir Water Treatment Plant (BRWTP) Source Water Protection and Treatment Improvements including the Carter Lake Pipeline. This information summarizes staff efforts to evaluate alternatives and information needed to support a decision regarding whether to move ahead with design and construction of the Carter Lake Pipeline.

Including the Carter Lake Pipeline Project in the 2008 Budget (and the 2008-2013 CIP) is not a final decision by the City Council to construct the project. City Council will still have the following "off-ramp" opportunities to stop its participation/funding in this project:

- Review and approval of the CEAP (early 2008)
- Review and approval of the proposed 2009 Budget (Fall 2008)
- Issuance of Water Utility Revenue Bond (Summer 2009 or later)

Additional technical information is also available in the technical reports listed as Attachments in the WRAB agenda item memo. These attachments are 250 pages long and are available for review upon request or on the web at:

[http://www.bouldercolorado.gov/index.php?option=com\\_content&task=view&id=7318&Itemid=1189](http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=7318&Itemid=1189)

The Boulder Reservoir WTP is currently meeting all drinking water requirements and standards. For this reason the Carter Lake Pipeline has been identified as a discretionary project that it recommended based on its long term enhancement of the water system and value to the city.

Six alternatives were evaluated and there are differing professional opinions about the preferred course of action.

- Staff's and Planning Board's recommendation is that the Carter Lake Pipeline Project is the preferred long term capital improvement alternative.
- WRAB's recommendation is that the Carter Lake Pipeline Project not be pursued at this time and reviewed at some point in the future (perhaps 5-15 years).

The staff rationale for continuing to pursue the Carter Lake Pipeline Project includes the following:

#### Water Quality and Quantity

- Water quality in Carter Lake is of exceptional quality, similar to other city water sources such as Barker and Silver Lake Reservoirs.
- The quality of the water delivered from Carter Lake through the 21-mile long, open, earthen canal, referred to as the Boulder Feeder Canal (BFC) experiences significant degradation, primarily due to surface water runoff that contains chemical and pathogenic microorganisms and adjacent septic/leach fields along the canal. The water in Boulder Reservoir is subject to additional degradation from body contact and motor boat recreation, increased dissolved solids and salt content due to the dissolution of naturally occurring minerals in Boulder Reservoir sediments and occasionally has objectionable tastes and odors in the water that are the result of seasonal algal blooms and increased manganese due to oxygen depletion in Boulder Reservoir. In addition, the planned recreation trail along the BFC and the planned recreation improvements (Parks and Recreation Master Plan) at Boulder Reservoir will increase the risk of water quality degradation events.
- The quality of the water delivered via the BFC is subject to accidental and intentional dumping/contamination.
- As water demands increase in the future to serve the build-out population, the city is relying on the Boulder Reservoir WTP to provide a greater percentage of the water. The pipeline would provide increased reliability and flexibility for delivery of water the entire year (the BFC operates 8-9 months).
- Although there are treatment processes capable of removing contaminants from the water, it is better to preclude contaminations from entering the water in the first place.
- A pipeline that delivers water directly from Carter Lake would mostly eliminate these issues.

#### Cost and Finances

- The city currently has the opportunity to leverage money for construction of the pipeline with several other agencies including the Left Hand Water District, the Little Thompson Valley Water District and the Town of Frederick. The city and these agencies recently completed a feasibility study and are currently developing permit applications for the pipeline project through the Northern Colorado Water Conservancy District (NCWCD). There does not appear to be any significant community or environmental impacts of the project that cannot be mitigated. Permits will be required from both Larimer and Boulder Counties as a Matter of State Interest (1041J). The NCWCD previously acquired the majority of the right-of-way (ROW) needed to construct the pipeline along an alignment parallel to an existing pipeline that serves Broomfield and Superior.
- The Carter Lake Pipeline Project has been included in the city's Federal Priorities and lobbying efforts and has received support from several elected officials.

While federal funds have not been appropriated for this project, there is still a possibility that federal funds may be appropriated in the next 1-3 year period.

- During the past five years, heavy construction costs have escalated at 22.5 to 50 percent, based on the Engineering News Record or Colorado Department of Transportation Construction Cost Indices, respectively. Delaying the construction of the pipeline may result in substantially higher costs at a later date.
- If the Carter Lake Pipeline is not constructed, it is likely the city will need to invest in additional treatment processes in the future. Although the treatment processes may not be as costly to construct initially, they require higher on-going operation and maintenance costs and do not have as long a useful life as the pipeline.
- An alignment within the existing right-of-way (ROW) of the pipeline constructed in 1995 from Carter Lake to Broomfield is currently available.
- Revenue bonds to fund the project would be issued and, although interest rates are no longer at historic lows, they remain very favorable

#### WRAB Recommendation

The WRAB did not agree with the staff recommendation and voted 3-2 at their June 28 meeting to delay construction of Boulder's portion of the Carter Lake Pipeline and consider it as a future phase for implementation, after the following actions have occurred:

- Construction of planned treatment improvements at the WTP have been completed (anticipated to be 2010)
- Reduce or eliminate existing discharges from adjacent properties into the Boulder Feeder Canal
- Significantly reduce the existing bonded indebtedness (existing revenue bonds are scheduled to be paid off in 2016, 2019, 2020 and 2021).

The WRAB was concerned about the rate increases that would be necessary to fund the pipeline when the water currently meets regulatory standards. Dissenting board members supported the staff recommendation and indicated that the pipeline is a necessary improvement to protect the safety of the water and it is better not to delay the project.

#### Planning Board Recommendation

The Planning Board unanimously (6-0) recommended the Carter Lake Pipeline Project at their July 19th meeting and review of the proposed 2008-2013 CIP.

#### Utility Staff Recommendation

Staff recommends that the pipeline planning, design and construction proceed as soon as possible. The next step would be to complete the Community and Environmental Assessment Process (CEAP) with money already appropriated in the existing 2007 budget. Although staff is requesting that City Council appropriate \$1 million in the 2008 budget for design of the pipeline, these funds would not be spent until the CEAP is approved by City Council. In addition, the projected expense of \$25 million in 2009 is also conditional on approval of the CEAP and final City Council action to issue revenue bonds.

### Next Steps

Staff will be prepared to discuss this issue in more detail at the July 31<sup>st</sup> study session.

Questions for City Council regarding this issue may include:

1. Would Council like to schedule a separate study session or public hearing to consider more information regarding this issue?
2. Should staff proceed with the Community and Environmental Assessment Process (CEAP) with money appropriated in the existing 2007 budget?
3. Should \$1 million for design of the Carter Lake Pipeline be budgeted in 2008 with the understanding that no design money will be spent until the CEAP is approved?
4. What additional information does Council need to make this decision?

### Attachment

A - Agenda item memo from the June 28, 2007 Water Resources Advisory Board (WRAB) meeting regarding the Integrated Evaluation of the Boulder Reservoir Water Treatment Plant (BRWTP) Source Water Protection and Treatment Improvements including the Carter Lake Pipeline. Also on the web at:

[http://www.bouldercolorado.gov/index.php?option=com\\_content&task=view&id=7318&Itemid=1189](http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=7318&Itemid=1189)

## ATTACHMENT A

**CITY OF BOULDER  
WATER RESOURCES ADVISORY BOARD  
AGENDA ITEM  
MEETING DATE: June 28, 2007**

**AGENDA TITLE:** Integrated Evaluation of the Boulder Reservoir Water Treatment Plant (BRWTP) Source Water Protection and Treatment Improvements.

**PREPARING DEPARTMENT:**

Robert E. Williams – Director of Public Work for Utilities  
Anne Noble – Utilities Project Manager  
Bob Harberg – Utilities Planning and Project Management Coordinator  
Bret Linenfelser – Water Quality and Environmental Services Coordinator  
Randy Crittenden – Water Treatment Coordinator  
Carol Ellinghouse – Water Resources Coordinator

**BOARD ACTION REQUESTED:** WRAB recommendation to support the Carter Lake Pipeline as the preferred long term capital improvement alternative for the Boulder Reservoir Water Treatment Plant.

**FISCAL IMPACT:** The proposed 2008-2013 CIP includes \$1 million in 2008 to design and \$25 million in 2009 to construct a pipeline from Carter Lake to the BRWTP.

**PURPOSE:** Attached (Attachment A) is the final report prepared by Black & Veatch (B&V) Consulting Engineers on the Integrated Evaluation of the Boulder Reservoir Water Treatment Plant (BRWTP) Source Water Protection and Treatment Improvements, which recommends that the city move forward with the construction of a pipeline from Carter Lake to the Boulder Reservoir Water Treatment Plant. Also attached are: a peer review (Attachment B) of the B&V report prepared by Susumu Kawamura, Black & Veatch's response (Attachment C) to the peer review, responses to WRAB questions submitted to staff in May 2007 (Attachment D) as well as the analysis of the WRAB decision model scores based on scoring by Black and Veatch and scoring by Kelly DiNatale (Attachment E).

**BACKGROUND:**

On March 19, 2007, the draft report on the Integrated Evaluation of the Boulder Reservoir Water Treatment Plant (BRWTP) Source Water Protection and Treatment Improvements was presented to the Water Resources Advisory Board. At the time, seven alternatives were identified and evaluated. All of the alternatives assumed the construction of mid-term improvements at the

treatment plant which includes treatment with chlorine dioxide (ClO<sub>2</sub>). These alternatives assumed three source water options: seasonal use of the Boulder Feeder Canal, year-round use of the Boulder Reservoir and the Carter Lake Pipeline. Treatment processes were paired with each of these source water options and the alternatives were evaluated based on a performance ranking, as well as the present worth cost. At the April 16, 2007 and May 21, 2007 WRAB meetings, staff provided additional information in response to questions and comments from the Water Resources Advisory Board, including the evaluation of membrane filtration as an alternative and the evaluation of the alternatives using criteria and scoring provided by the WRAB. In May, 2007, in order to simplify the evaluation process, the number of alternatives was reduced to six, based on the assumption that the BRWTP would continue to utilize both of the current water sources or a pipeline from Carter Lake would be constructed.

### ANALYSIS:

The six alternatives that were brought forward in the final report include:

- Alternative 1: Chlorine Dioxide (ClO<sub>2</sub>) only
- Alternative 2: ClO<sub>2</sub> and Ultraviolet (UV)
- Alternative 3: ClO<sub>2</sub>, UV and Granular Activated Carbon (GAC)
- Alternative 4: ClO<sub>2</sub> and Membrane Filtration/Ultrafiltration (MF/UF)
- Alternative 5: ClO<sub>2</sub> and Advanced Oxidation Process (Ozone)
- Alternative 6: ClO<sub>2</sub> and Carter Lake Pipeline

A decision process for evaluating the alternatives was developed that utilized a performance ranking as well as a net present cost. Criteria were developed by city staff to rank each of these alternatives. Each criterion was weighted based on the consensus of its relative importance. The six final alternatives were numerically rated based on their ability to meet each criterion. The criteria, relative weighting and performance score for each alternative are shown in Chapter 6 of the report and are summarized in Attachment E of this memorandum, along with the WRAB Decision Model Scores. The WRAB developed a separate decision model, which evaluated the alternatives based on eight criteria, including cost. Four WRAB members individually developed relative weights for these criteria, which were then used to score the alternatives. Black & Veatch scored the alternatives based on their assessment of each alternative to meet the criteria. The alternatives were also scored by Kelly DiNatale.

The first three alternatives would not meet the city's water quality goals with respect to TDS and sulfates when raw water is provided from the reservoir. Alternative 1, the baseline alternative, would not meet the city's water quality goals with respect to pathogens and does not provide an effective organic micro-pollutant barrier. With the addition of UV disinfection, Alternative 2, provides adequate pathogen inactivation, but this alternative would not provide an effective barrier for organic micro-pollutants. With the addition of GAC, Alternative 3, the concern of organic micro-pollutants would be addressed. Alternative 4, membrane filtration, addresses pathogens, but not micro-pollutants or TDS and sulfate. Alternative 5, advanced oxidation (ozone) provides barriers for pathogens and micro-pollutants, but not TDS and Sulfates. Alternative 6, the Carter Lake Pipeline meets all of the city's water quality goals and provides at least one barrier for each contaminant category evaluated.

A net present cost was calculated for each alternative, taking into account both capital and operations and maintenance costs. A 30 year life cycle was assumed for treatment plant processes, with a 70 year life cycle for the pipeline. The remaining value of the pipeline was credited back in the net present cost evaluation. Operations and maintenance costs included power, chemicals and consumables. The cost of staffing the facility was not included as it was assumed to be constant for all of the alternatives. Capital costs were not included for the mid-term treatment plant improvements. However, maintenance costs for the mid-term improvements were included in all of the alternatives as it was assumed these improvements would be completed prior to the long-term improvements. The present worth cost, capital cost and operations and maintenance (O&M) costs (in \$million) are described in chapter 7 of the report and are shown below:

Alternative	Description	Present Worth Cost	Capital Cost	O&M Costs
1	ClO2 only	\$5.2	\$0	\$0.17
2	ClO2 & UV	\$9.3	\$2.4	\$0.21
3	ClO2 & UV & GAC	\$53.4	\$21.9	\$0.86
4	ClO2 & MF/UF	\$29.3	\$13.2	\$0.42
5	ClO2 & Ozone	\$26.9	\$13.6	\$0.33
6	ClO2 & Pipeline	\$17.2	\$21.1	\$0.19

### **RECOMMENDATION**

Staff recommends moving forward with the Carter Lake Pipeline. Protection of the BRWTP source water through investing in the construction of the Carter Lake Pipeline will provide long-term benefits to the city. The city is placing a greater reliance on this facility than in the past due to continued planned growth in the city's water service area. Even though current regulatory requirements are being met, the risk of contaminants entering the source water and passing through the treatment process still exists. Investing in a pipeline that will protect the source water for the BRWTP far into the future is a worthwhile investment similar to that undertaken by prior generations with the Silver Lake Watershed.

The quality of water in Carter Lake is excellent. It is a deep reservoir with a small natural runoff area and is filled mostly with high quality water imported from the Western Slope. These factors are significantly different than factors affecting water quality in the Boulder Feeder Canal and Boulder Reservoir, both of which are negatively affected by a much more significant area of existing development and agriculture. Future development and agricultural practices will likely exacerbate these negative effects. The threat of accidental or intentional contamination is also a concern because of limited ability to react or dilute such contamination.

The city of Boulder is currently participating in the development of right-of-way acquisition plans and permit applications for the Southern Water Supply Project II (Carter Lake Pipeline). Other participants include Little Thompson Water District, the town of Frederick and Left Hand Water District. The pipeline is estimated to cost \$33 million. Depending upon the number of participants, the city of Boulder's share of the cost can range from \$20 to \$25 million. Attached are excerpts from the Northern Colorado Water Conservancy District (NCWCD) Southern Water Supply Project II Feasibility Study prepared by Integra Engineering in January, 2006 (Attachment F).

The Carter Lake Pipeline will address both the near-term and potential increase in degradation to water quality of the BRWTP. Although water treatment technology has advanced, treatment processes do fail. Preventing source water contamination provides a more robust barrier than subsequent treatment. The Carter Lake Pipeline would also provide a much more uniform water quality, substantially simplifying the treatment optimization and increasing treatment process reliability. Although the capital cost of the Carter Lake Pipeline is significant, it is comparable to the cost of treatment technologies that afford a similar level of water quality protection and with the assurance that contaminants will be prevented from entering the city's source water in the first place, rather than attempting to remove these contaminants via treatment.

The pipeline would also provide opportunities and flexibility for improvements in the management and operation of the city's raw water facilities. These include possible hydroelectric power generation as well as improvements in the flexibility of use of the City's various water sources for the BRWTP. This increased flexibility could provide a slight increase in the drought year yield of the City's water rights portfolio.

Water source selection flexibility would be improved by providing a redundant means of supplying BRWTP. At present, source options include drawing directly from the Boulder Feeder Canal or pumping from Boulder Reservoir. Since the canal is shut down from about November to April of each year, the Carter Lake Pipeline would provide a second option for water delivery to BRWTP in the winter months. If one of the present source options is unavailable for operational reasons, such as a power outage to the pumps or herbicide spraying on the canal, the Carter Lake Pipeline would provide the flexibility of an additional means of providing water.

It is likely that if the Carter Lake Pipeline were built that it would be used as the sole means of supplying BRWTP at most times, but the options of using Boulder Reservoir water or canal water would remain for use during drought or emergency. This increased flexibility in water supply facilities at BRWTP might provide a slight increase in the yield of the City's Windy Gap water supplies during drought periods. If the City is able to access its CBT allotment directly from the storage pool in Carter Lake during the winter, the City's winter Boulder Reservoir account can be filled with Windy Gap water each year. At present, it is filled with CBT water from the allotment given in the year that is closing. If this close-out CBT allotment can be accessed from Carter Lake during the winter, it would no longer need to be placed in Boulder Reservoir storage before the canal shuts down in the fall. If the Windy Gap water that is then stored in Boulder Reservoir for the winter is not delivered into the BRWTP over the course of the winter, it can be exchanged up to Barker Reservoir in the spring for later use at Betasso. The increased availability of storage space for Windy Gap water and the increased ability to exchange Windy Gap effluent back into the City's water system until it is fully consumed might provide a slight increase in water yield during moderately dry periods when exchange potential exists. This in turn would allow the City to carryover higher amounts of CBT water under the City's account within the CBT storage reservoirs that could be used during drought periods.

The cost of the pipeline as currently proposed is less than it might be at a later time because there is an opportunity to share costs in constructing the Carter Lake pipeline with other communities. Additionally, on-going construction cost inflation suggests that the cost of constructing the

pipeline will only increase in the future. The majority of the pipeline right-of-way (ROW) has been previously secured by the NCWCD. Continued development pressure along this ROW may make future construction more difficult. Securing the remaining ROW for a pipeline at this time is also considered important because of these development pressures. Also, the cost of borrowing money is near an all time low. These factors suggest that now is a good time to proceed with this project as a long term investment in the city's water utility infrastructure.

**ATTACHMENTS:**

- Attachment A:** Final Report on the Integrated Evaluation of Boulder Reservoir Water Treatment Plant (BRWTP) Source Water Protection and Treatment Improvements prepared by Black & Veatch Consulting Engineers, June 18, 2007.
- Attachment B:** Peer Review for the Draft Report on Boulder Reservoir Water Plant prepared by Susumu Kawamura dated May 31, 2007
- Attachment C:** B&V's Responses to the Peer Review
- Attachment D:** Questions and Answers on the Integrated Evaluation of the Boulder Reservoir Water Treatment Plant Source Water Protection and Treatment Improvements dated June 2007
- Attachment E:** WRAB Decision Model scored by B&V and scored by Kelly DiNatale
- Attachment F:** Excerpts from the Southern Water Supply Project II Feasibility Study

