

**CITY OF BOULDER  
WATER RESOURCES ADVISORY BOARD  
INFORMATION ITEM**

**MEETING DATE: March 28, 2016**

**AGENDA TITLE:** Information Item – Carter Lake Pipeline

**PRESENTER/S:**

Jeff Arthur, Director of Public Works for Utilities  
Joe Taddeucci, Water Resources Manager  
Bret Linenfelser, Water Quality and Environmental Services Manager  
Tom Settle, Water Treatment Manager  
Douglas Sullivan, Acting Principal Engineer – Water, Wastewater, and Stormwater  
Ken Baird, Utilities Financial Manager

**EXECUTIVE SUMMARY:**

In establishing the 2017 capital improvements program (CIP), the City of Boulder must reach a final decision regarding participation in the Northern Colorado Water Conservancy District's (hereinafter Northern) Southern Water Supply Project II (hereinafter Carter Lake Pipeline). A decision is required in 2016 because the project schedule requires 2017 funding for final design, and because final design cannot proceed for other project participants until Boulder's involvement is determined.

The purpose of this item is to present an overall summary of the project and provide WRAB an opportunity to ask questions or request additional information prior to making a June recommendation on the 2017 CIP.

**BACKGROUND:**

Boulder's water supply comes from the following three sources: 1) the Middle Boulder Creek watershed; 2) the North Boulder Creek watershed; and 3) west slope water through the Northern system. Middle and North Boulder Creek sources are treated at the Betasso Water Treatment Plant and Northern supplies are treated at the Boulder Reservoir Water Treatment Plant. Boulder's three water sources and two treatment plants are a result of Boulder's long-term planning principles for system reliability, redundancy and flexibility. Boulder relies on Northern supplies for about one third of its annual water supply on average. **Attachment 1** provides a perspective map view of Boulder's water sources, and **Attachment 2** shows a graphic illustration of the annual composition of Boulder's water sources.

The Carter Lake Pipeline will not change the quantity of Northern supplies available to Boulder, but it would change the delivery mode of water used for treatment. Some of the water currently delivered in Northern's St. Vrain Supply Canal and Boulder Feeder Canal would instead be delivered through a closed, pressurized pipeline. **Attachment 3** provides a map of the proposed pipeline alignment and the existing canal system. The pipeline will be owned and operated by

Northern and will deliver Colorado-Big Thompson (CBT) and Windy Gap water to project participants, including the City of Boulder, Left Hand Water District, and Longs Peak Water District. The participants will each own a share of capacity in the pipeline and will provide all necessary funding for construction and operation and maintenance. Boulder's share of the overall project cost is estimated to be about \$35,000,000 and Boulder would pay up to \$158,000 per year for operations and maintenance.

Boulder's consideration of participation in the Carter Lake Pipeline dates back to an April 2003 Source Water Quality Planning Study. Staff and WRAB deliberated on the pipeline for several years, including evaluating water treatment and source water protection alternatives, and in 2007 agreed upon a measured path forward that included financial participation in Carter Lake Pipeline permitting activities and right-of-way (ROW) acquisition. In 2008, City Council approved \$1,000,000 in funding for permitting and ROW acquisition activities. That work is now mostly complete and most of the funding has expended. In 2009, City Council approved the Source Water Master Plan, which included the Carter Lake Pipeline as part of the Water Utility Fund 20-year CIP.

Boulder's participation in the Carter Lake Pipeline project was originally considered for the source water protection and water quality benefits of a pipeline compared to the existing canal system. The 2013 flood event and heavy rains in the spring of 2015 each made the canal system inoperable and exposed an additional vulnerability that had not been considered in previous Carter Lake Pipeline evaluations.

Additional background information is provided in **Attachment 4**.

#### **ANALYSIS:**

Staff analysis of the Carter Lake Pipeline has considered a number of factors, including: Boulder's reliance on Northern supplies, seasonal considerations, operational considerations, water quality considerations, water treatment alternatives, flood resiliency and financial considerations. A summary of each of those factors follows.

Reliance on Northern Supplies – Northern deliveries are an important source of Boulder's water supply. Boulder cannot meet its current water demand solely from Boulder Creek sources, and reliance on Northern supplies will likely increase as Boulder moves towards buildout and contends with climate change. As a theoretical illustration of this, staff compared average annual demand to Boulder's supply for the past 20 years as if Northern supplies had not been available (see **Attachment 5**). In this scenario, supply would have been short of customer demand in most years and water restrictions would have been likely. WRAB, City Council and a community study group who participated in the 2009 Source Water Master Plan recognized Northern's importance to Boulder's water supply and identified the Carter Lake Pipeline as a "no regrets" action subject to funding availability.

Seasonal Considerations - The existing canal system is not capable of winter operation, so Boulder must estimate its winter supply needs and ensure that water is delivered to Boulder Reservoir before the canal is taken offline each November. The seasonal canal deliveries and winter reservoir storage currently do allow year-round access to Northern supplies when necessary. Sometimes Boulder Creek source and treatment facilities, some of which are 100 years old, need to be taken offline for extended maintenance or CIP projects. These projects

typically occur in the winter when treated water demands are lower. The pipeline, with direct and continuous access to Northern supplies, would provide for more reliable winter supply than is currently provided by the reservoir. The pipeline's direct and continuous winter connection would also provide access to more of Boulder's water in the Northern system if Boulder encountered extremely low winter snowpack or drought concerns or in the event of a major unexpected issue on the Betasso side of the system.

Operational Considerations – Currently when Boulder places a water delivery order or makes a delivery change with Northern, the time required for the water to travel from Carter Lake to Boulder Reservoir is about 12 hours through the canal system. Because the Carter Lake Pipeline will be pressurized, Boulder will receive its desired order immediately once Northern adjusts flow.

The city is at the downstream end of the canal system, and delivery timing and flows can be affected by upstream operational changes and overall demand. At times the city can be one of few or the only call for water and very low flows delay delivery and adversely affect quality. At other times, upstream users' operations can unintentionally impact Boulder's deliveries. A pipeline will eliminate such issues.

Water Quality Considerations - All Boulder municipal water meets applicable water quality standards at present. However, there can be noticeable differences in taste and odor in water supplied from the Boulder Reservoir Treatment Plant compared to water supplied from the Betasso Water Treatment Plant. Source water quality at Carter Lake is similar to that of the city's high quality Boulder Creek water sources, but can degrade as a result of open canal transport and storage in Boulder Reservoir. Furthermore, as a necessary measure to control plant and algal growth and retain capacity in the canal system, Northern applies herbicides directly to the water and canal banks as part of the canal maintenance. Boulder does not divert water from the canal during such treatments. However, some herbicide active ingredients (from both canal maintenance and other unknown sources) have been detected in the finished water, although at concentrations well below regulated maximum contaminant levels.

Due to the small watershed area (which reduces runoff potential) and depth of the waterbody, Carter Lake has displayed minimal degradation since data collection began, and is expected to continue to serve as a long-term reliable source of high quality water. Boulder is home to a number of major employers that depend on a reliable municipal water supply to produce their products and services. Boulder businesses as diverse as pharmaceutical companies, breweries, and data centers are impacted by variations in water chemistry supplied by the Boulder Reservoir Treatment Plant, especially when raw water from Boulder Reservoir is used. The ability to provide water of more consistent quality would be beneficial to these types of customers in reducing their pretreatment needs.

Flood Resiliency - The 2013 flood event caused catastrophic damage to the Boulder Feeder Canal and caused extreme sediment loading to Boulder Reservoir, which rendered the Boulder Reservoir Water Treatment Plant inoperable for approximately one month. The canal damage required lengthy repairs. The same flood caused extreme road damage to all access routes to the Betasso Water Treatment Plant. Fuel and chemicals were just barely able to reach Betasso in time because of the road damage. Had the fuel and chemical deliveries not been possible, both of Boulder's treatment facilities would have been unavailable at the same time, and Boulder

would have potentially been without drinking water. Similarly, had the flood event unfolded in the same exact way it did in September but instead occurred in June, July or August when both treatment facilities are required to meet demand, restrictions would have been likely.

The original Southern Supply Pipeline, which does not serve Boulder, is a buried steel pipeline and also was subjected to the 2013 flood. This pipeline withstood the flood and was the only available source out of five for a neighboring municipality. The proposed Carter Lake Pipeline would also be a buried steel pipeline.

The heavy rains that occurred in the spring of 2015 were not as extreme as the 2013 flood. However, concrete canal panels were damaged and canal deliveries were unavailable for an extended duration for the second time in two years, despite Northern's responsive repair efforts. The Carter Lake Pipeline would dramatically reduce, if not eliminate, the chance of delivery interruptions due to floods and extreme weather.

Water Treatment Alternatives - The city's water quality monitoring and treatment processes must consider a continuously evolving list of contaminants detected and regulated at the state and federal level. While there are presently no regulatory changes requiring immediate modifications to city water facilities, the strategy for achieving the city's water quality goals is to protect the drinking water supply through a combination of source water protection measures and treatment processes. The city assessed the addition of improvements at the Boulder Reservoir Treatment Plant and determined that substantial treatment process upgrades would be required to achieve the same water quality results as can be achieved with a pipeline and existing treatment facilities. The capital cost of the treatment process improvements might be more or less expensive than the Carter Lake Pipeline depending on which processes were ultimately chosen. The ongoing operations and maintenance costs of treatment processes upgrades could be significantly more than the annual cost of pipeline maintenance. Regardless, no treatment alternative can provide the flood resiliency benefits of a pipeline, eliminate the operational delivery interruptions associated with the canal system, ensure a more consistent water quality year round, or provide the same seasonal supply reliability of a pipeline.

Another relatively recent development involves disposal of sediment residuals (sludge) resulting from treatment processes. Since the 2013 flood, contaminants have been detected at higher concentrations in the residuals during routine monitoring. Staff believes the precipitation events may have generated enough runoff to carry these additional contaminants into the canal and reservoir. The city has been successful in removing the contaminants from finished drinking water, but the contaminants could eventually reach a threshold that would make disposal of residual materials significantly more expensive and less environmentally sustainable. A pipeline would eliminate such contaminants being intercepted by the canal and carried into the reservoir.

Funding Considerations – As mentioned previously, the 2009 Source Water Master Plan's recognition of the Carter Lake Pipeline as a "no regrets" action was subject to funding availability. Staff's current evaluation of the Carter Lake Pipeline project has focused on Boulder's ability to fund it without compromising other Water Utility system priorities and without requiring unacceptable increases to Water Utility rates. Staff has determined that the Carter Lake Pipeline's inclusion in the CIP can be done within the rates proposed last year and will not require deferral of other priority projects.

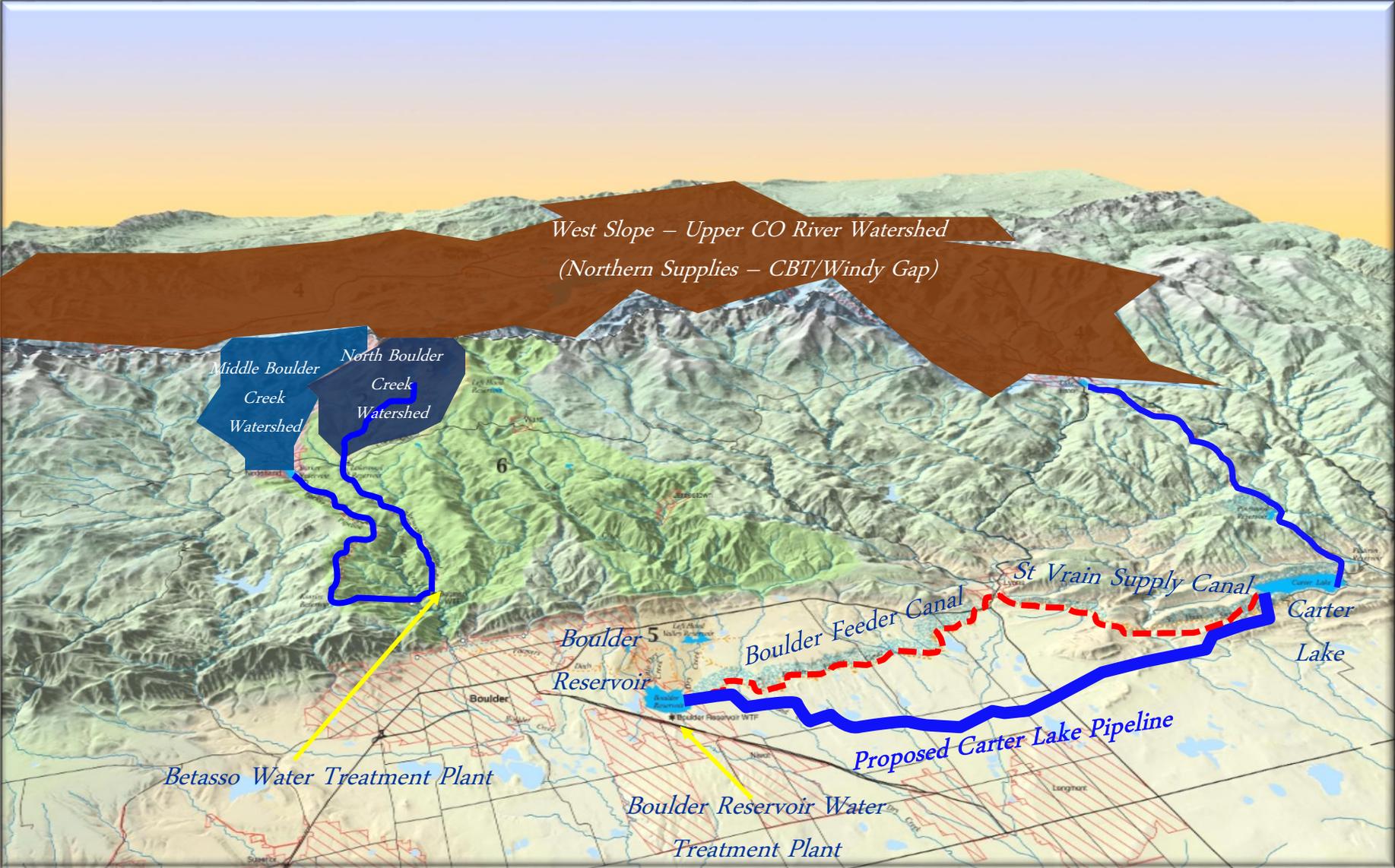
**NEXT STEPS:**

Staff is seeking WRAB's feedback on the Carter Lake Pipeline so that any additional information can be provided prior the June 2016 WRAB meeting when staff will request a final board recommendation concerning the proposed 2017-2022 CIP.

**ATTACHMENTS:**

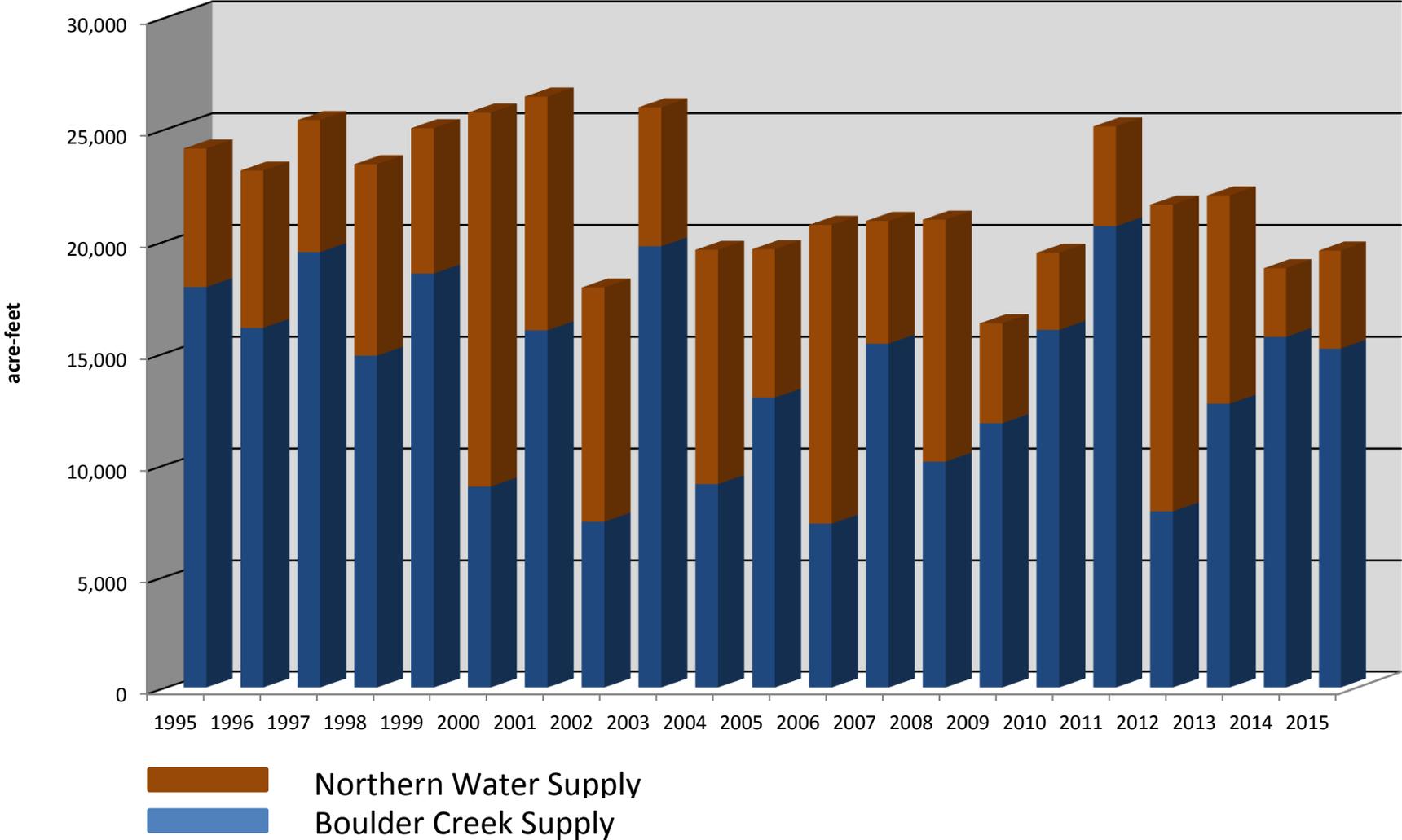
- A. Boulder's Source Water System Map
- B. Boulder's Water Supply Composition
- C. Carter Lake Pipeline Alignment Map
- D. Table of Additional Background Information
- E. Boulder's Water Supply without Northern Supplies vs. Demand (bar chart)

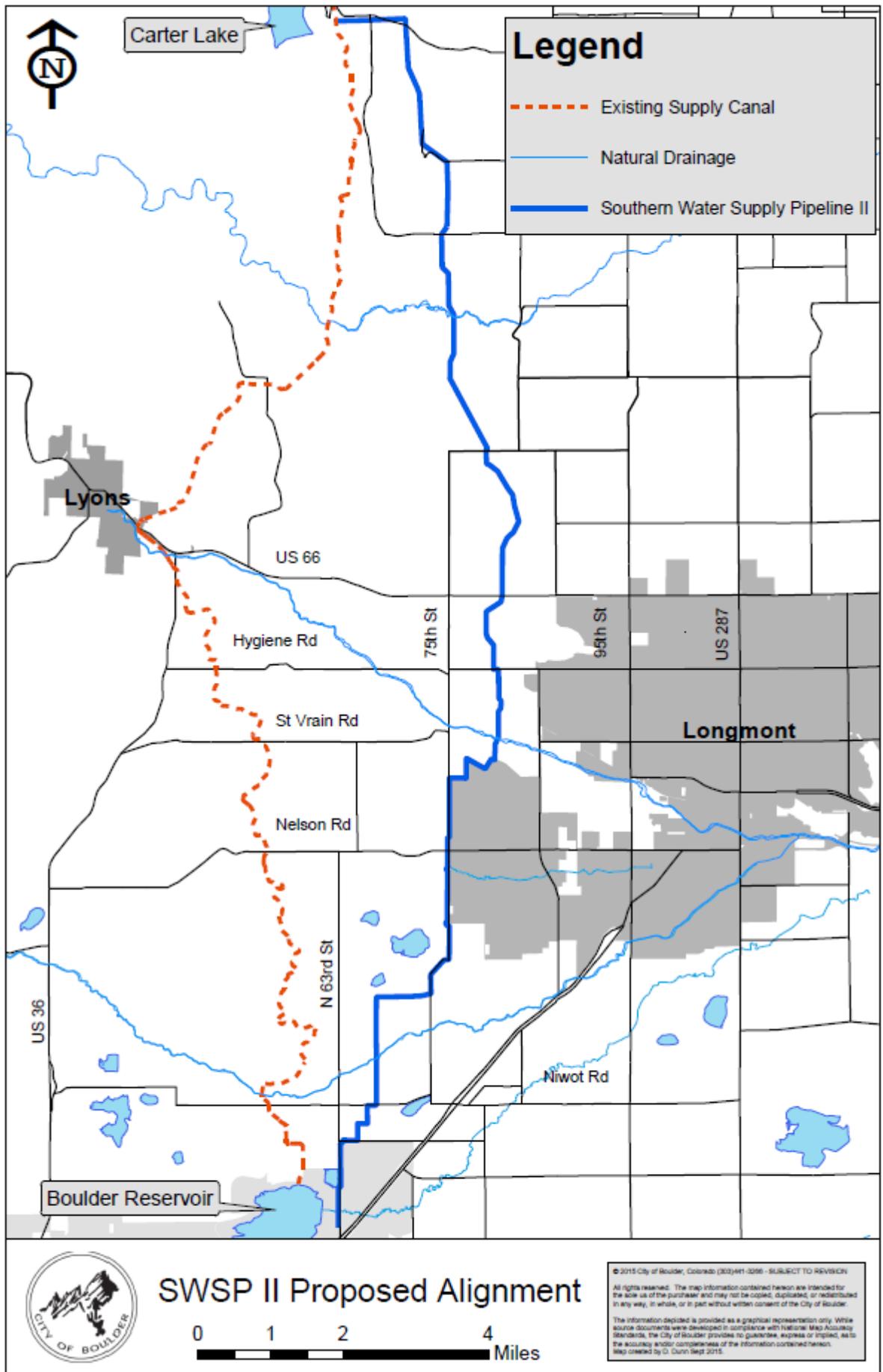
**Attachment 1 – Boulder's Source Water System**



Attachment 2 - Boulder's Water Supply Composition

City of Boulder Water Sources





**Attachment 4-Carter Lake Pipeline Additional Background Information**

ITEM	DESCRIPTION
Basic Pipeline Facts	Length ..... Approximately 20 miles Diameter ..... 33 to 36 inches Material ..... Steel
Project Cost (Permitting, Right-of-Way Acquisition, Design and Construction)	Total Project Cost ..... \$46 Million City of Boulder Cost ..... \$35 Million (32 cfs capacity) Left Hand Water District Cost ..... \$10 Million (11 cfs capacity) Longs Peak Water District Cost ..... \$1 Million (3cfs capacity)  Cost allocation is primarily appropriated among participants based on percentage of overall capacity owned. However, each participant will completely fund project features for which it is the only user. For example, Left Hand Water will fund its portion of the pipeline that branches off of the main pipeline, and Boulder will fund the portion of the pipeline between the Left Hand Water branch and Boulder Reservoir.
Annual Operation and Maintenance Costs (Estimated at 0.5% of Construction Costs)	Total Annual O&M Cost ..... \$211,000 City of Boulder Cost ..... \$158,000 Left Hand Water District Cost ..... \$47,000 Longs Peak Water District Cost ..... \$6,000  In any given year, any unused cash balance for the pipeline O&M assessment carries over and is subtracted from the subsequent year's O&M assessment. For illustration purposes, if a participant's annual O&M assessment by agreement was \$100,000, and actual O&M costs for the year were \$60,000, a carryover of \$40,000 would be made for the subsequent year and the participant's O&M assessment for the subsequent year would be \$60,000.
Funding Strategy and Timing	Carter Lake Pipeline is currently scheduled for construction in 2018 but was originally scheduled to be completed several years earlier. Northern and the other project participants agreed to delay the project in order for Boulder to retire (in 2016) previous utility bonds associated with past projects. Boulder will fund Carter Lake Pipeline construction by issuing utility bonds starting in 2018.
Water Supply Costs of Service	Northern Water completed a <a href="#">Cost-of-Service Rate Study</a> in 2014. The result of the Study is that open Colorado Big Thompson (CBT) rates are on an increasing trend from \$28 per acre-foot to \$56.20 per acre-foot from 2014 to 2018 for municipal and industrial customers. By way of comparison based on very rough estimates, it costs the City of Boulder about \$300 per acre-foot to deliver source water to the treatment facilities.
Remaining Project Timeline	2016 and early 2017 ..... ROW acquisition activities completed 2017 ..... Final design 2018-2019 ..... Construction

**Attachment 4-Carter Lake Pipeline Additional Background Information**

ITEM	DESCRIPTION
Pipeline Right of Way (ROW) Acquisition	<p>Northern began ROW acquisition starting in 2008 and is planning to complete all necessary acquisitions by early 2017. Most of the remaining acquisitions involve City of Boulder property. The final Carter Lake Pipeline alignment crosses property with a number of City of Boulder interests. The pipeline crosses Open Space and Mountain Parks Department conservation easements jointly owned with Boulder County. It crosses Tom Watson Park, which is on an IBM easement owned by the city's Parks and Recreation Department. The pipeline also crosses Boulder Reservoir property owned by the Utilities Division of the Public Works Department and managed by the Parks and Recreation Department. Easements for the Utilities and Open Space and Mountain Parks Department property will require City Council action.</p> <p>The northern portion of the Carter Lake Pipeline is in the same alignment as the existing Southern Water Supply Project. The original SWSP owner agreement (1995) included an escalation clause for the value of the ROW of 9 percent per year. The participants of the Southern Water Supply Project II (Carter Lake Pipeline), including the City of Boulder, funded ROW acquisition well in advance of construction partly to avoid additional expenses due to the ROW escalation.</p>
Project Permits	<p>Northern completed a Boulder County 1041 process and a Larimer County location and extent review process for the Carter Lake Pipeline. The project is subject to regulation by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. A Pre-Construction Notification for the pipeline impacts was sent to the U.S. Army Corps of Engineers and the project has been permitted under Nationwide Permit (NWP) 12 for utility lines. There are also a variety of routine construction permits typically required for pipeline projects, including county building permits, CDOT/County Utility permits, construction stormwater discharge permits and construction dewatering permits. These permits will either be obtained by Northern or the construction contractor.</p>
Northern Water/Pipeline Participant Agreements	<p>Pipeline design, permitting and ROW acquisition activities to date have been addressed by interim agreements between Northern and each of the project participants. Prior to construction in 2018, Boulder and Northern will execute an agreement to formalize each party's long-term interests and responsibilities associated with the pipeline. The agreement will formalize the ownership arrangement (Boulder will own capacity/Northern will own the pipeline) and payment terms and conditions among other things. By executing this agreement, Boulder will be making a perpetual commitment to its stake in the pipeline. However, Boulder would always have the option of selling its CBT and Windy Gap water and its share in the pipeline should it ever choose to do so.</p>
Past WRAB/Council Action	<p>In March 2007, staff presented the Integrated Evaluation of the Boulder Reservoir Water Treatment Plant Source Water Protection and Treatment Improvements to the Water Resources Advisory Board (WRAB) and requested that WRAB support the Carter Lake Pipeline as the preferred long-term capital improvement alternative. In June 2007, WRAB voted 3 to 2 to delay construction of the Carter Lake Pipeline primarily due to the costs, until other treatment alternatives had been constructed and practical and cost-effective</p>

**Attachment 4-Carter Lake Pipeline Additional Background Information**

ITEM	DESCRIPTION
	improvements to the Boulder Feeder Canal had been completed. In September 2007, WRAB approved a consensus proposal supporting continuing work related to pipeline planning, preliminary engineering, permitting and right-of-way acquisition, while evaluating other utility capital improvement and operating priorities. In November 2007, City Council approved the 2008 Capital Improvement Plan and budget, which included \$1 million for permitting and right-of-way acquisition for the Carter Lake Pipeline. In 2009, City Council approved the Source Water Master Plan, which included a recommendation to proceed with the Carter Lake Pipeline provided an adequate funding plan could be established.
Boulder County 1041 Process	Northern Water submitted its 1041 application for the Southern Water Supply Project II to Boulder County in May 2009. Following lengthy and detailed consideration of Northern's preferred alternative in comparison to a more urban alternative route through Longmont, the Board of County Commissioners ultimately approved Northern's preferred alignment in July 2012. The approval includes 34 detailed design and construction requirements that Northern must meet to ensure the project can satisfy the applicable 1041 criteria regarding preservation of productive agricultural land, comply with the Boulder County Comprehensive Plan and effectively mitigate the environmental impacts associated with the project.
Public Process Summary	The project went through a lengthy public process with the Boulder County Commissioners during the county 1041 proceedings that concluded in 2012. There were three public hearings, and four alignment alternatives that were formally studied as part of the process. The project had two public open houses (one at the Boulder Reservoir Water Treatment Plant and one at Left Hand Water's facilities). The project was also highlighted throughout development of the 2009 Source Water Master Plan, including discussions during public and stakeholder outreach. Prior to the county 1041 process, a city Community and Environmental Assessment Process (CEAP) was initiated and presented alternatives mainly in the form of a budget decision (fund the project or not). The CEAP process was put on hold in 2009 pending the outcome of the parallel county 1041 process. In 2015 it was determined that a CEAP was not an ideal process to facilitate public engagement since the completed county process had already performed an extensive environmental assessment and established an alignment and since the only remaining decision concerning Boulder's project participation was whether or not to fund the project. As such, it was determined that the 2017 capital improvements and budget process, which includes opportunity for public involvement, was the appropriate mechanism to perform a final and thorough evaluation of the project.
Boulder to Lyons Recreation Trail Planning	One community item of interest has been the status of the proposed Lyons to Boulder regional trail, one potential alignment for which is along Northern's Boulder Feeder Canal. City and county staff have previously evaluated the potential of moving forward with trail development. City staff prepared a CEAP document for the trail in 2006. In 2009, Northern indicated that it was not likely to grant permission for use of any part of its Boulder Feeder Canal ROW for the trail. While the pipeline and trail projects are separate projects, staff anticipates that the pipeline's inclusion in the capital improvements program and 2017 budget may result in renewed interest in the trail. Northern Water is managing the pipeline project as a service to the

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ITEM	DESCRIPTION
	pipeline’s participants and otherwise does not have an interest in the pipeline that would be incentive to reconsider its position on the trail. Boulder to Lyons trail planning efforts, including consideration of other alignments, are ongoing in cooperation between the city and Boulder County.
Boulder Reservoir Operations (post pipeline)	There will be no significant changes to Boulder Reservoir levels post-pipeline. In general, the level of Boulder Reservoir gradually increases between May 1 and July 1 and gradually decreases between July 1 and April 30 of each year. Summer reservoir levels are largely determined by Northern Water operations unrelated to Boulder’s municipal deliveries. Winter storage levels are primarily determined both by the amount of “winter storage water” Boulder orders and the amount of water treated at Boulder Reservoir Water Treatment Plant over the winter. Historically, Boulder has ordered between two and four thousand acre feet of winter water to be delivered to Boulder Reservoir by November 1 of each year for treatment and winter municipal use and for early season exchanges. Although Boulder does not anticipate routinely treating water from the reservoir post-pipeline, Boulder will continue to have the option to order winter storage water to maintain a supplemental winter storage supply at BRWTP at no additional cost. Depending upon whether Boulder orders winter storage water, the May 1 reservoir storage level may be higher or lower than it has been historically. Regardless, the general pattern of gradual increase through July 1 and decrease over the fall and winter will continue. Pumping water from Boulder Reservoir into the treatment plant requires an average of approximately 100,000 kilowatt hours of electricity per year and costs about \$7,000 per year. These costs and energy consumption would decrease after completion of the Carter Lake Pipeline.
Boulder Feeder Canal Operation (post pipeline)	The Boulder Feeder Canal will continue to operate for agricultural water deliveries and the city’s exchange water after the pipeline is constructed. The participants’ municipal water deliveries will no longer be conveyed through the canal the majority of the time, but the canal will still be available (providing an additional level of redundancy) should the pipeline be offline for maintenance purposes. The city may take its exchange water through the pipeline (up to the limit of Boulder’s owned capacity) in the future should development of a hydroelectric facility be deemed feasible).
Boulder’s Water Source Selection Principles	In wet years when water is more abundant, Boulder preferentially draws more from its Boulder Creek sources in order to generate renewable energy through the city’s eight hydroelectric facilities. In dry years, Boulder uses more Northern Water as a drought protection measure to preserve storage in its Boulder Creek sources. Future reliance on Northern supplies will likely increase as Boulder moves towards buildout and contends with climate change.
Hydroelectric Potential	An additional benefit associated with the Carter Lake Pipeline would be an opportunity to develop the hydroelectric power potential of the pipeline should it prove economically feasible. The terminal structure at Boulder Reservoir will be designed to allow for the future addition of hydroelectric equipment.

**Attachment 5 - Boulder's Water Supply vs. Demand (without Northern Supplies)**

