WATER RESOURCES ADVISORY BOARD MEETING

MEETING DATE: Monday, 18 April 2016

MEETING TIME: 7:00 p.m.

MEETING LOCATION: Municipal Services Center, 5050 E. Pearl St., Boulder, CO 80301

Agenda Highlights:

1. Call to Order (7:00 p.m.)
2. Swearing in of new WRAB member (7:01 p.m.)
3. Election of Officers (7:05 p.m.)
4. Approval of March 28, 2016 Meeting Minutes (7:10 p.m.)
5. *Public Comment (7:15 p.m.)
6. Information Item – Wastewater Collection System Master Plan Update (7:20 p.m.)
7. Information Item – Stormwater Collection System Master Plan Update (7:50 p.m.)
8. Information Item – Capital Improvements Program Overview (8:50 p.m.)
9. Matters from Board (9:10 p.m.)
10. Matters from Staff (9:20 p.m.)
    - Water Supply Update
    - Fourmile Canyon Creek Mitigation
11. Discussion of Future Schedule (9:50 p.m.)
12. Adjournment (10:00 p.m.)

* Public Comment Item

Agenda item times are approximate.

Information:

- Please contact the WRAB Secretary email group at: WRABSecretary@bouldercolorado.gov
- Packets are available on-line at: http://www.bouldercolorado.gov – A to Z, Water Resources Advisory Board (WRAB), Next Water Resources Advisory Board Meeting

CITY OF BOULDER, COLORADO
BOARDS AND COMMISSIONS MEETING MINUTES

Name of Board / Commission: Water Resources Advisory Board

Date of Meeting: 28 March 2016

Contact Information of Person Preparing Minutes: Rene Lopez 303-413-7149

Board Members Present: Vicki Scharnhorst, Dan Johnson, Mark Squillace, Lesley Smith, Mike Barnes
Board Members Absent: None

Staff Present: Jeff Arthur, Director of Public Works for Utilities
Joe Taddeucci, Water Resources Manager
Douglas Sullivan, Acting Principal Engineer for Water, Wastewater and Stormwater
Tom Settle, Water Treatment Manager
Steven Buckbee, Engineering Project Manager
Michelle Wind, Drinking Water Program Supervisor
Kevin Clark, Engineering Project Manager
Eric Ameigh, Sr. Project Manager
Joanna Bloom, Source Water Administrator
Kate Dunlap, Source Water Quality Program Coordinator
Justin Greene, Finance Data Analyst
Ken Baird, Utilities Financial Manager
Annie Noble, Acting Principle Engineer for Flood and Greenways
Rene Lopez, Board Secretary

Consultants Present: None

Meeting Type: Regular

Agenda Item 1 – Call to Order **[8:02 p.m.]**

Agenda Item 2 – Approval of the 22 February 2016 Meeting Minutes **[8:05 p.m.]**
Motion to approve minutes from 22 February 2016 as amended.
Moved by: Squillace **Seconded by:** Barnes
Vote: 5:0

Agenda Item 3 – Public Participation and Comment **[8:06 p.m.]**
Public Comment: none

Agenda Item 4 – Information Item – Capital Improvement Program **[8:07 p.m.]**

Ken Baird, Joanna Bloom, Kevin Clark and Joe Taddeucci presented this item.

Executive Summary from the Packet Materials:

As part of the city's annual budget process, Utilities develops a six-year planning budget, this year for the time period of 2017 through 2022. Within this process, funds are appropriated for the first year, 2017. The Water Resources Advisory Board (WRAB) role in this process is defined in the Boulder Revised Code; ". . . to review all environmental assessments and capital improvements conducted or proposed by the utilities division." This agenda item is intended to initiate this process by providing:

- Background information
- Anticipated CIP highlights
- Schedule of key milestones

For reference, this packet includes materials from the adopted 2016 Utilities Budget and the 2016-2021 Utilities Capital Improvement Program (CIP) which was approved by City Council last fall. This information can be found in Attachment A – Water Utility, Attachment B – Wastewater Utility and Attachment C -Stormwater / Flood Management Utility. In addition, the citywide CIP document (2016 Annual Budget Vol. II) and other budget documents can be found in a links on the following webpage: https://bouldercolorado.gov/budget.
No formal action by the WRAB is requested at this time. WRAB recommendation on the CIP will be scheduled for the June 20 meeting. A public hearing will be scheduled for both the May 16 and June 20 budget discussions.

WRAB Discussion Included:

- Wittemeyer ponds – cost benefit analysis
- Enterprise funds for each utility
- Barker Dam pipeline lining
- Rate increase – average cost per single family

Agenda Item 5 – Information Item – Carter Lake Pipeline **[8:41 p.m.]**

Joe Taddeucci presented this item.

Executive Summary from the Packet Materials:
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.

WRAB Discussion Included:

- Feedback on CIP public open house
- Discussions regarding future water use trend projections
- Bond rate discussions
- Cost benefit analysis requested
- Top 10 reasons to proceed with the project requested

Agenda Item 5 - Matters from Board: **[9:56 p.m.]**

- Johnson
  - Look at ways of generating revenue in excess of today's revenue
  - Rate structure this fall
- Smith
  - Recourse for selling water to fracking companies
  - Discussions on the water main break isolation times from the Norwood main break

Agenda Item 6 – Matters from Staff: **[10:10 p.m.]**

- Polling board members for summer schedules
- Civic area memo to council
- Officially recognize Vicki's contribution to WRAB

Agenda Item 7 – Future Schedule **[10:13 p.m.]**

- Water supply memo in April
- Water efficiency plan moved to later in 2016
- 4 mile creek for GAC

Adjournment **[10:15p.m.]**
There being no further business to come before the Board at this time, by motion regularly adopted, the meeting was adjourned at 10:15 p.m.
Motion to adjourn by: Squillace **Seconded by:** Johnson
Motion Passes 5:0

Date, Time, and Location of Next Meeting:
The next WRAB meeting will be **Monday,** April 18th 2016 at **7:00 p.m.,** at the **City's Municipal Services Center, 5050 East Pearl St., Boulder, CO 80301**

APPROVED BY:

_____
Board Chair

_____
Date

ATTESTED BY:

_____
Board Secretary

_____
Date

An audio recording of the full meeting for which these minutes are a summary, is available on the Water Resources Advisory Board web page.
https://bouldercolorado.gov/boards-commissions/water-resources-advisory-board-next-meeting-agenda-and-packet

C I T Y O F B O U L D E R
WATER RESOURCES ADVISORY BOARD
AGENDA ITEM

MEETING DATE: April 18, 2016

AGENDA TITLE: Information Item – 2016 Wastewater Collection System Master Plan

PRESENTERS:
Jeff Arthur, Director of Public Works for Utilities
Douglas Sullivan, Acting Principal Engineer for Water, Wastewater and Stormwater
Pieter Beyer, Civil Engineer II

EXECUTIVE SUMMARY:

Utilities staff is in the process of completing an update to the City's 2009 Wastewater Collection System Master Plan (WWCSMP). The new master plan will replace the previous document. The 2009 WWCSMP included a GIS based hydraulic model, a comprehensive analysis of the existing sanitary sewer system, and a list of prioritized recommended projects for the City's Wastewater Utility CIP. The 2016 WWCSMP was undertaken to revise the sanitary sewer system hydraulic model, to include recently acquired flow monitoring data, and to incorporate inspection information regarding flow diversion structures in the upstream collection system. The 2016 update also considers the collection system performance during and since the 2013 flooding.

The master plan recommendations include a total of 11 CIP projects – four high priority Tier 1 projects, and seven medium priority Tier 2 projects. These 11 projects will replace the recommended projects identified in the 2009 WWCSMP. These collection system projects will be incorporated into the Wastewater Utility Fund CIP next month once the final draft of the master plan is completed. **Figure 1** is a map of the wastewater collection system showing the Tier 1 and Tier 2 recommended projects.

FISCAL IMPACTS:

The 2009 WWCSMP identified four Tier 1 projects and seven Tier 2 projects. In 2009, the estimated cost for the Tier 1 and Tier 2 projects was $5,000,000 and $23,000,000 respectively. The 2016 Master Plan also includes four Tier 1 projects, however, these projects are different and significantly larger in scope than the projects identified in the previous master plan. The four new Tier 1 projects are focused on larger diameter sanitary sewer pipes that were discovered to have significant internal corrosion issues during the 2014 condition assessment program, and were sized to accommodate a higher level of service for wet weather flows. Therefore, the rehabilitation cost associated with the new Tier 1 projects will be significantly greater than those identified in the previous

master plan cost estimate. However, the City secured a $10,000,000 Wastewater bond in 2015 that will fund some portion of the Tier 1 replacement projects.

BACKGROUND:

The previous Wastewater Collection System Master Plan was completed in 2009 by HDR Engineering. That master plan provided recommendations for improvements to sewers 10 inches in diameter or larger. These improvements were based on the goal of creating a sewer conveyance system that was capable of accommodating wet weather wastewater flows that would be generated by a 10-year rainfall event. The 10-year storm frequency was used because it was estimated to generate a 50 mgd flow at the WWTF, which corresponds well to the facility's hydraulic capacity.

During the 2013 flood the wastewater collection system experienced an extreme volume of inflow and infiltration (I&I) entering the system which caused numerous sanitary sewer overflows (SSO's) and building sewer backups throughout the City. The resulting flow at the WWTF was estimated to be in excess of 50 mgd because that flow rate, which represents the upper limit of the flow gauge, was recorded for a period of seven consecutive days.

In order to better understand the source of this extraneous water entering the sanitary sewer system, City staff implemented an intensive flow monitoring program in 2015. The city has since purchased flow meters that provide continuous sanitary sewer flow data. As a result of this program, the City has acquired high quality wet weather sewer flow data that were used to revise and calibrate the master plan's hydraulic model. The recently collected flow data provide a higher level of confidence in the hydraulic model than the model that was developed for the 2009 WWCSMP. The flow monitoring program was one of several reasons to proceed with the WWCSMP update at this time.

Another reason the master plan update was undertaken was to review the practical and financial implications of raising the system's level of service to accommodate potential wet weather flows generated from up to a 25-year rainfall event. The value of this approach is that it would reduce the frequency and severity of SSOs and backups during extreme weather events.

ANALYSIS:

The following section provides an overview of the information that was used for the master plan update process, and presents how the analysis was performed, how the problem areas were identified, and the resulting project recommendations.

New System Data

The primary set of new information that was utilized for the update process was wet weather sewer flow data that was acquired through the City's extensive flow monitoring efforts undertaken since the 2013 flood. In 2014 the City contracted with Stantec Engineers to perform an intensive system-wide flow monitoring study which utilized 60 temporary flow meters deployed over a 4-month duration. The City has since installed

nine permanent flow monitoring stations on its main trunk sewers. The data captured from these flow meters has provided a better understanding of the system's response to severe weather events.

Utilities staff also inspected numerous flow diversion structures within the sanitary sewer system which allow wastewater flows to be diverted between multiple downstream sewers depending on the level of flow during wet weather events. The inspections revealed that some of the assumptions made during the 2009 WWCSMP regarding how these structures operated were inaccurate. The hydraulic model parameters have since been revised and the correct flow split manhole configurations have been incorporated in the 2016 WWCSMP.

Identification of Problem Areas

The master plan recommendations are based on a review of the hydraulic model results for several different flow scenarios including dry weather flows during current and 2035 flow conditions as well as wet weather flows during a 15, 20, and 25-year storm event. The following constraints were then applied to analyze the sewer network and to identify any sewer section which violated these constraints during the various flow scenarios. These sewer sections were flagged as problem pipes based on the following criteria:

1. Local Collector / Local System (8-inch – 24-inch)
    a. Sanitary sewer overflows (SSO) prohibited
    b. Peak-hour average dry weather flow level not to exceed a half full pipe (50% d/D)
    c. Peak-hour wet weather low level not to exceed 60 percent of full pipe (60% d/D)
2. Interceptor / Collector System (> 24-inch) System
    a. Sanitary sewer overflows (SSO) prohibited
    b. Peak-hour dry weather flow not to exceed 70 percent of full pipe (70% d/D)
    c. Peak-hour wet weather flow not to exceed 80 percent of full pipe (80% d/D)

The flow conditions during wet weather flow scenarios generally dictate the problem sewer dataset and only a small number of sewers were identified to be a problem during dry weather conditions. A comparison of the wet weather scenarios also revealed that as the intensity of the storm and extraneous wastewater increased, the problem locations generally remained the same but increased in severity. These problem locations were projected to experience more severe overflows and backups, thus affecting more sewers in the upstream and downstream directions near the problem area.

Project Recommendations

The dataset of problem sewers identified through application of the aforementioned criteria were grouped into three types of problem areas.

- <u>Type A</u> problem areas include a series of connected larger diameter conveyance sewers that are all significantly under capacity. Type A problem areas account for 247 problem sewers with a total length of 12.8 miles (3.5% of sewer system).
- <u>Type B</u> problem areas include isolated problem sewers in the larger diameter conveyance sewers that are not connected to other problem areas. Type B

problem areas account for 125 problem sewers with a total length of 3.9 miles (1.1% of sewer system).

- Type C problem areas include isolated smaller diameter local sewers that are under capacity or isolated larger diameter sewers that are only marginally violate the problem criteria. Type C problem areas account for 128 problem sewers with a total length of 6.3 miles (1.8% of sewer system).

The Type A problem areas were selected for further study and review under the master plan as they represent the large scale type of improvements whose funding levels requirements necessitate advanced planning within the framework of the CIP. Type B and C problem areas will be addressed through isolated smaller improvement projects and through opportunistic collaboration with other City CIP projects when possible.

The Type A problem areas were prioritized into two prioritization tiers; a high priority Tier 1, and a medium priority Tier 2, through review of factors such as the extent and severity of the problem area, the potential frequency of SSOs, the risk of building backups, and what severity of storm is required for the problem area to exhibit violation of the problem criteria. Application of these factors resulted in the problem area prioritization shown in Table 1.

Table 1 – 2016 WWCSMP Project Prioritization

Problem Priority	Improvement ID	Improvement Location
Tier 1	Boulder Creek 3	Valmont Rd and 61st St to WWTP
Tier 1	South Boulder Creek 2	Foothills Pkwy, Baseline Rd
Tier 1	Boulder Creek 2	Arapahoe Ave and Foothills Pkwy to Old Tale Rd; South Boulder Creek corridor
Tier 1	Goose Creek 4	Foothills Pkwy and Pearl St
Tier 2	Goose Creek 1	19th Street from Kalmia Ave to Grape Ave
Tier 2	South Boulder Creek 1	Table Mesa Dr, South Boulder Rd, S 46th St
Tier 2	Boulder Creek 1	Colorado Ave and 28th St
Tier 2	Goose Creek 3	28th Street from Pine St to Walnut St
Tier 2	Goose Creek 2	Folsom St/Glenwood Dr/Valmont Rd
Tier 2	Gunbarrel 1	Boulder and Left Hand Ditch; Idylwild Tr/Boulder Country Club
Tier 2	Gunbarrel 2	Along Boulder Supply Canal north of Jay Rd

NEXT STEPS:

City staff will present the Final Draft 2016 Stormwater Master Plan at the May 16, 2016 WRAB Meeting. WRAB will be asked to make a recommendation to City Council to accept the revised plan. City Council will consider the updated plan later this year.

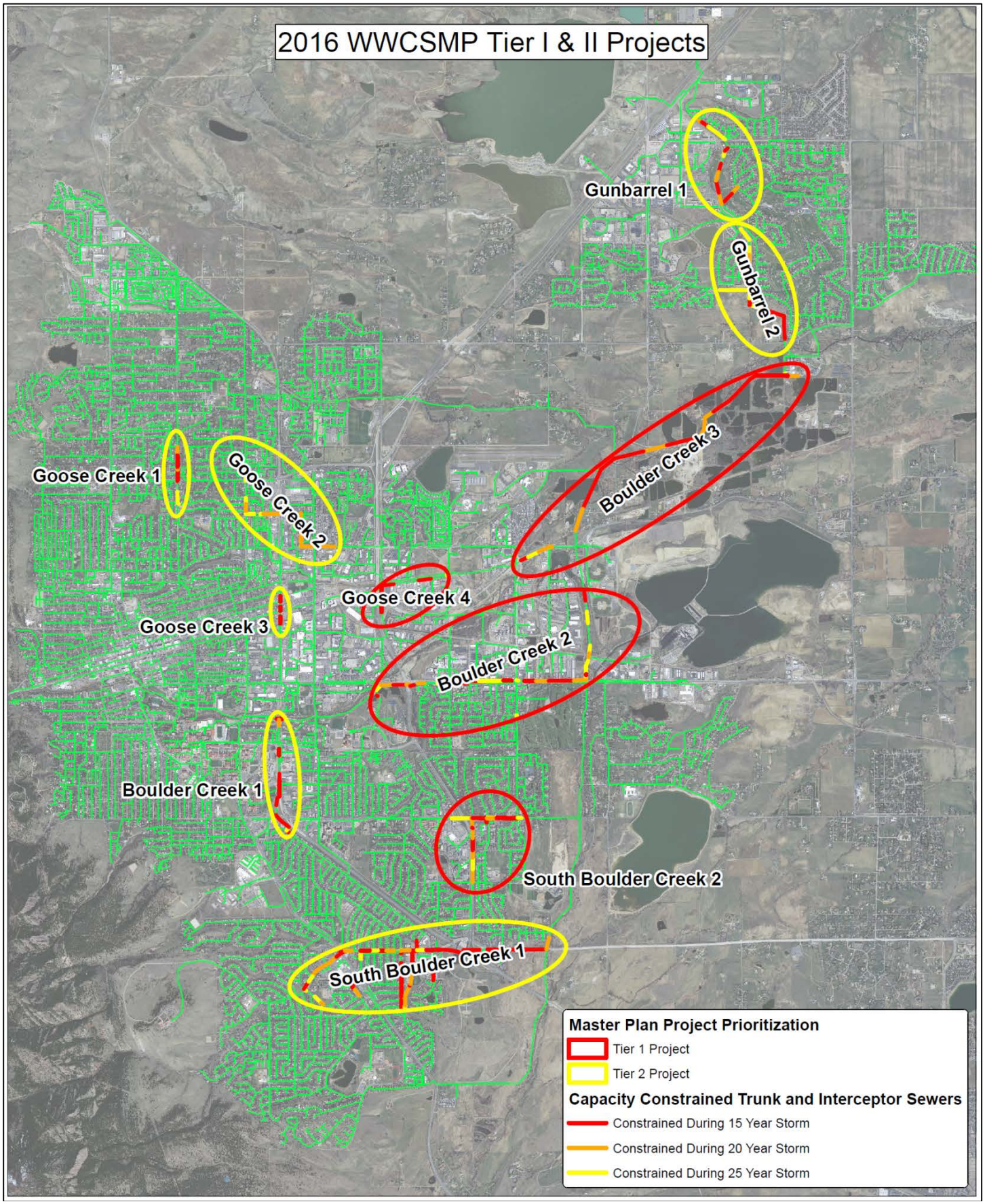


Figure 1 - 2016 WWCSMP Tier 1 and Tier 2 Project Recommendations

C I T Y O F B O U L D E R
WATER RESOURCES ADVISORY BOARD
AGENDA ITEM

MEETING DATE: April 18, 2016

AGENDA TITLE: Information Item – 2016 Stormwater Master Plan

PRESENTERS:
Jeff Arthur, Director of Public Works for Utilities
Douglas Sullivan, Acting Principal Engineer for Water, Wastewater and Stormwater
Pieter Beyer, Civil Engineer II

EXECUTIVE SUMMARY:

Utilities staff is in the process of completing an update to the City's 2007 Stormwater Master Plan (SMP). The new Stormwater Master Plan will replace the previous document. The 2007 SMP included a new GIS based hydrologic model, a comprehensive analysis of the existing storm sewer system, and a list of prioritized recommendations for the City's Stormwater and Flood Management Utility CIP. The 2016 SMP was undertaken to review the need for improvements in the smaller diameter storm sewers as well as the need to expand the storm sewer system into areas that are currently not served or underserved by storm sewer infrastructure. The 2016 SMP is therefore an evolution in the City's approach to master planning by also considering expansion of the storm sewer system in addition to addressing existing assets. The 2016 update attempted to integrate the flood inundation data received following the September 2013 flood event and the May 2015 significant rainfall event.

The new master plan will also include recommendations for steps that need to be taken to ensure compliance with the City's revised CDPHE municipal separate storm sewer system (MS4) permit which authorizes the City to discharge stormwater from storm sewers and City facilities. The revised MS4 permit was reissued in 2016 with significantly expanded regulatory requirements.

The 2016 master plan recommendations include a total of 10 new Tier 1 high priority projects to address drainage issues in underserved areas of the City. These 10 projects have an estimated cost of approximately $15 M. In 2007, the SMP identified four Tier 1 projects that represented hydraulic deficiencies, with a total estimated cost of approximately $20 M. Two of the original projects are located in the vicinity of the 10 projects identified in the 2016 SMP. Several programmatic changes to the City's Water Quality and Environmental Services programs to address permit compliance issues are also recommended. **Figure 1** is a map of the City's stormwater collection system

showing the Tier 1 and Tier 2 recommended projects from the 2007 SMP and the 2016 update. The combined recommendations have been integrated into one map.

FISCAL IMPACTS:

The regulatory compliance recommendations associated with the new MS4 permit do not represent significant cost implications to the Stormwater and Flood Management CIP. However, the underserved area analysis has resulted in the generation of 10 new Tier 1 high priority projects with an estimated project cost of approximately $15 M. This cost would likely be in addition to the estimated $20 M (in 2007 dollars) associated with the Tier 1 funding needs identified in the 2007 SMP for collector system improvements. The City is now faced with the opportunity to pursue two distinctly different types of projects. The underserved area projects represent a potential approach of expanding the storm sewer system into areas which currently are not served by storm sewers. The collector system projects represent a continuation of the current approach of ensuring that existing storm sewer maintain an adequate level of capacity.

The funding needs for the two types of Tier 1 projects will likely exceed the currently available City resources. Therefore, the challenge will be to identify and implement a program balancing the two types of projects to ensure that the storm sewer program is adequately addressing underserved areas while maintaining sufficient capacity in the existing collector system.

BACKGROUND:

The first City of Boulder storm sewer specific master plan was developed in 1984 by WRC Engineering. Prior to this master plan, storm sewer improvements were studied as a minor component of drainage basin-wide flood management plans.

The 1984 master plan divided the existing storm sewer system into local and collector systems and focused its analysis on ensuring that the existing collector system was capable of conveying the necessary level of storm runoff generated during the 2 and 5-year rainfall events. Although the 1984 master plan was the first master plan focusing on storm sewer infrastructure, it was not an all-inclusive master plan as it focused primarily on the larger diameter collection and conveyance sewers. This master plan also primarily reviewed the need for improvements to existing infrastructure and did not discuss the need for expansion of the system.

The next master plan, which was developed in 2007 by HDR Engineering, improved on the 1984 master plan through the utilization of a more accurate GIS-based mapping and more advanced hydraulic modeling techniques. However, it also only focused on improvements to the existing larger diameter system. Therefore, the 1984 and 2007 master plans have served as a good basis for identifying and prioritizing improvements to the existing storm sewer system.

The 2013 flooding resulted in extensive localized non-drainageway related flooding that highlighted “underserved” areas that are not served by storm sewers. The 2013 flood event identified a need to incorporate the flood inundation data and to identify where

additional improvements beyond those recommended in the 2007 SMP might be warranted.

The 2007 SMP also focused on the hydraulic analysis of stormwater conveyance and provided limited details on compliance with the City's Municipal Separate Storm Sewer System (MS4) Permit. The MS4 permit provides the authorization for the City to discharge storm water from storm sewers and City facilities to waters of the State. This lack of master plan level guidance on regulatory compliance was brought to the forefront by the re-issuance of the City's MS4 permit in 2016 which now includes greatly expanded regulatory requirements.

Because of the lack of focus in previous master plans on local drainage systems and regulatory compliance, the City is expanding and revising the 2007 SMP. The 2016 Stormwater Plan will include an analysis of areas of the City which may benefit from improvements to, and expansion of, the local collector systems as well as specific recommendations to guide the City to compliance with the updated stormwater quality regulations.

ANALYSIS:

The following section provides an overview of the information that was used for the 2016 master plan update process. This section presents how the identified problem areas based on this information were prioritized relative to each other, the resulting project recommendations, and the regulatory compliance recommendations for the new MS4 permit.

New Information

After the 2013 flooding, City staff initiated a comprehensive process to collect data on the extent of surface flooding, the severity of property damage, the source of flooding causing the damage, and the performance of the existing system during the flood. Boulder residents played an important role in these data collection efforts by reporting instances of flooding to the City's Public Works department call center during the flood, attending open houses to review and correct the City's data on flooding extents, and completing surveys on damage severity and flooding sources. Additionally, many residents provided first-person accounts of how various drainage systems performed or were impacted during the flood. This information was compiled into three distinct datasets which provided the foundation of the update process:

1. A detailed map showing the extent of surface flooding across the City
2. A database of properties impacted by the flooding, identifying damage that occurred in homes, and the source of the damage
3. The Public Works department call center log detailing the location and chronology of flooding throughout the City

The 2016 master plan update process also utilized the most recent storm sewer system mapping for the updated hydraulic modeling analysis, which includes system improvements and modifications made to storm sewers since the 2007 SMP.

The regulatory compliance recommendations were based on a review of the City's new MS4 permit requirements, a review of current practices, and a comparison of current practices to best practices currently implemented by other similar Front Range communities including Loveland and Fort Collins.

Project Prioritization

The local collector system analysis resulted in the identification of 35 "underserved" areas throughout the City that may benefit from the expansion or improvement to existing local storm sewer systems. HDR has estimated the implementation of improvements to address all 35 of these underserved areas would cost approximately $40,000,000. In order to evaluate the relative needs of each area and create a prioritized list of projects, the 35 underserved areas where divided into Type A and B areas. Type A areas are known problems areas reported by residents and Type B areas are problem areas that were not reported explicitly but rather inferred during the analysis of the 2013 flooding data. These Type A and B areas where then scored using the points matrix provided in Table 1.

Table 1 - Underserved Area Prioritization Matrix

Criteria	Description	Scoring if Applicable	Weight	Maximum Possible Points
Type A Problem Areas - CRM	Known problem areas identified by city staff through Constituent Relationship Management (CRM) database reports.	1 Point	3	3
Type A Problem Areas – 2013 Flood Report Area with SMP Improvement	Type A problem areas containing observations of flooding during the 2013 event and/or identified problem areas included within the locations of 2007 SMP recommended stormwater infrastructure improvements.	1 Point	4	4
Type A and B Problem Areas – Irrigation Ditch Storm Flow Reduction	Type A and B problem areas where improvements have the potential to remove stormwater from irrigation ditches	1 Point	2	2
Type A and B Problem Areas – Underserved Area	Type A and B problem areas that have been identified as having an observed lack of existing stormwater infrastructure.	1 Point	4	4
Type B Problem Areas – 2013 Flood Reports	Type B problem areas containing observations of flooding during the 2013 event	1 Point	2	2
Type B Problem Area – 2013 Flood Report Area with SMP Improvement	Type B problem areas containing observations of flooding during the 2013 event and within the locations of 2007 SMP recommended stormwater infrastructure improvements.	1 Point	3	3
Severity and Consequence of Flooding	Ranking of the severity and consequence of flooding based on factors such as potential impact to roadways, potential property damage, maintaining emergency services (etc.).	High = 3 Points Medium = 2 Points Low = 1 Points	10	30

Project Recommendations

Application of the scoring matrix shown in Table 1 resulted in a scoring distribution ranging from a maximum score of 43 to minimum score of 12. Underserved areas achieving a score of 30 or more are considered high priority Tier 1 areas. Areas scoring between 20 and 30 are considered medium priority Tier 2 areas, and those areas scoring below 20 are considered low priority Tier 3 areas. A summary of the underserved areas, scoring, prioritization, and project cost estimates is provided in Table 2.

Table 2 - Underserved Area Prioritization and Improvement Costs

Problem Name	Recommended Improvement Type	Scoring	Priority	Improvement Cost
Elmer's Twomile Creek – 2	New and Replacement Storm Drain	43	Tier 1	$2,256,000
Goose Creek – 1	New and Replacement Storm Drain	41	Tier 1	$1,136,000
Goose Creek – 2	New and Replacement Storm Drain	41	Tier 1	$1,608,000
Dry Creek No. 2 - 3	New and Replacement Storm Drain	39	Tier 1	$4,319,000
Bear Canyon Creek - 3	Hydraulic Improvement	38	Tier 1	$1,305,000
Goose Creek - 3	New and Replacement Storm Drain	37	Tier 1	$590,000
Dry Creek No. 2 - 1	New and Replacement Storm Drain	37	Tier 1	$1,349,000
Middle Boulder Creek - 2	New and Replacement Storm Drain	35	Tier 1	$2,399,000
Wonderland Creek - 1	New and Replacement Storm Drain	33	Tier 1	$148,000
Bear Canyon Creek - 5	Hydraulic Improvement	32	Tier 1	$113,000
			Tier 1 Sub-total	**$15,223,000**
Goose Creek - 5	New Storm Drain	29	Tier 2	$748,000
Wonderland Creek - 7	New Storm Drain	28	Tier 2	$2,012,000
Wonderland Creek - 2	New Storm Drain	27	Tier 2	$1,534,000
Twomile Canyon Creek - 1	New Storm Drain	27	Tier 2	$2,262,000
Viele Channel - 1	New Storm Drain	27	Tier 2	$724,000
Goose Creek - 4	New Storm Drain	26	Tier 2	$3,928,000
Bear Canyon Creek - 4	New Storm Drain	26	Tier 2	$584,000
Middle Boulder Creek - 3	New and Replacement Storm Drain	25	Tier 2	$2,252,000
Fourmile Canyon Creek - 1	New Storm Drain	24	Tier 2	$569,000
Bluebell Canyon Creek - 1	New and Replacement Storm Drain	23	Tier 2	$954,000
Bear Canyon Creek - 1	New Storm Drain	23	Tier 2	$65,000
			Tier 2 Sub-total	**$15,632,000**
Dry Creek No. 2 - 2	New and Replacement Storm Drain	17	Tier 3	$570,000
Dry Creek No. 2 - 5	New Storm Drain	16	Tier 3	$1,931,000
Dry Creek No. 2 - 6	New Storm Drain	16	Tier 3	$1,354,000
Goose Creek - 6	New and Replacement Storm Drain	16	Tier 3	$1,510,000
Goose Creek - 8	New and Replacement Storm Drain	16	Tier 3	$758,000
Wonderland Creek - 6	New Storm Drain	16	Tier 3	$289,000
Dry Creek No. 2 - 4	New Storm Drain	16	Tier 3	$780,000
Dry Creek No. 2 - 8	New and Replacement Storm Drain	15	Tier 3	$488,000
Goose Creek - 7	New and Replacement Storm Drain	15	Tier 3	$210,000

Elmers Twomile Creek - 1	New Storm Drain and Open Channel	13	Tier 3	$95,000
Middle Boulder Creek - 1	New Storm Drain and Open Channel	13	Tier 3	$133,000
Dry Creek No. 2 - 7	Replacement Storm Drain	12	Tier 3	$656,000
Wonderland Creek - 3	New Open Channel	12	Tier 3	$24,000
Wonderland Creek - 4	New Open Channel	12	Tier 3	$20,000
			Tier 3 Sub-total	**$8,818,000**
			Tier 1 - 3 Total	**$39,673,000**

Regulatory Compliance Recommendations

The City's MS4 permit includes nine minimum control measures (MCM), which provide a set of requirements for the management, operation, and maintenance of the City's MS4 program. Also included is a set of additional requirements specific to addressing the E.coli impairment of Boulder Creek from 13th Street to its confluence with South Boulder Creek. The new MS4 permit greatly expands the requirements of the City under the nine MCM's and includes additional monitoring and documentation requirements showing progress towards the goal of remedying the impairment. A summary of the recommendations for items to be implemented in addition to current City efforts in order to comply with these new requirements is provided below.

- <u>MCM 1 – Public Education and Outreach</u>
  - The City currently has an extensive education program and future requirements are much less prescriptive than the level of outreach the City currently achieves. New requirements can easily be met through minor changes in outreach delivery methods.

- <u>MCM 2 – Public Involvement and Participation</u>
  - The new MS4 permit increases requirements in this MCM by dictating that a Program Description Document be created that formalizes the City's program which is available to the public on the City's website.

- <u>MCM 3 – Illicit Discharge Detection and Elimination</u>
  - Compliance with this MCM will require additional focus on illicit discharge detection including implementation of the following recommendations:
    - Clarify the City's enforcement escalation process for stormwater violations of City code.
    - Increased recordkeeping to comply with documentation requirements.
    - Establish a program to target hot spots and business types that are known to pollute.

- <u>MCM 4 – Construction Site Stormwater Runoff Control</u>
  - Compliance with this MCM will require extensive work to develop a new construction site stormwater runoff management program. The master plan update includes numerous recommendations for the program framework.

Considerable staff resources will likely be required to develop the guidance documents and implement the program across both public and private construction sites within the City.

- MCM 5 – Post-Construction Stormwater Management
  - Compliance will require increasing the frequency with which permanent BMPs are inspected and formalizing how public and private permanent BMPs are managed as well as transferred from the construction stormwater phase to permanent maintenance. Additional specific action items include:
    - Implementing standardized processes for requiring permanent BMPs on City projects.
    - Update maintenance requirements for underground BMPs for both public and private project and implement a formalized maintenance program for City owned BMPs.
    - Moving the inspection of private BMPs into the Stormwater Quality Program.
    - Increasing the number of spot inspections of both construction and post-construction BMPs.

- MCM 6 – Pollution Prevention and Good Housekeeping
  - This MCM addresses the management of not only the storm sewer system itself, but also stormwater practices at all City facilities. The operation and maintenance of storm sewer system is considered to be adequate to meet the new permit requirements, but the following additional action items are needed to ensure compliance at other City facilities.
    - Implement site-specific permanent water quality measures for individual City facilities that include BMPs specific to the activities conducted at each facility.
    - Designate a point person at each facility to be stormwater lead, advised and supported by the WQES staff.
    - Develop an implementation plan and construct any additional containment required by new secondary containment requirements for chemical storage tanks.
    - Provide and track additional stormwater training at all City facilities.
    - Integrate the City's WQES staff into the street sweeping program.
    - Equip all City vehicles handling pollutants of concern with spill kits and implement additional spill training for Municipal Services Center staff.

- <u>Other Requirements - Monitoring and Sampling</u>
  - The city is currently performing water quality sampling, however, recommendations are made to evaluate *E. coli* and nutrient concentrations and associated flows to develop storm event-based loadings from the MS4 permit. Specific recommendations include the following:
    - Set up permanent flow monitors at two sites along Boulder Creek to determine pollutant loads.
    - Perform storm event-based nutrient and E. coli sampling and flow monitoring.
    - Monitor dry weather flow in MS4 outfalls to Boulder Creek and set up temporary flow monitors at location with dry weather flows to understand flow patterns.

<u>NEXT STEPS:</u>
City staff will present the Final Draft 2016 Stormwater Master Plan at the May 16, 2016 WRAB Meeting. WRAB will be asked to make a recommendation to City Council to accept the revised plan. City Council will consider the updated plan later this year.

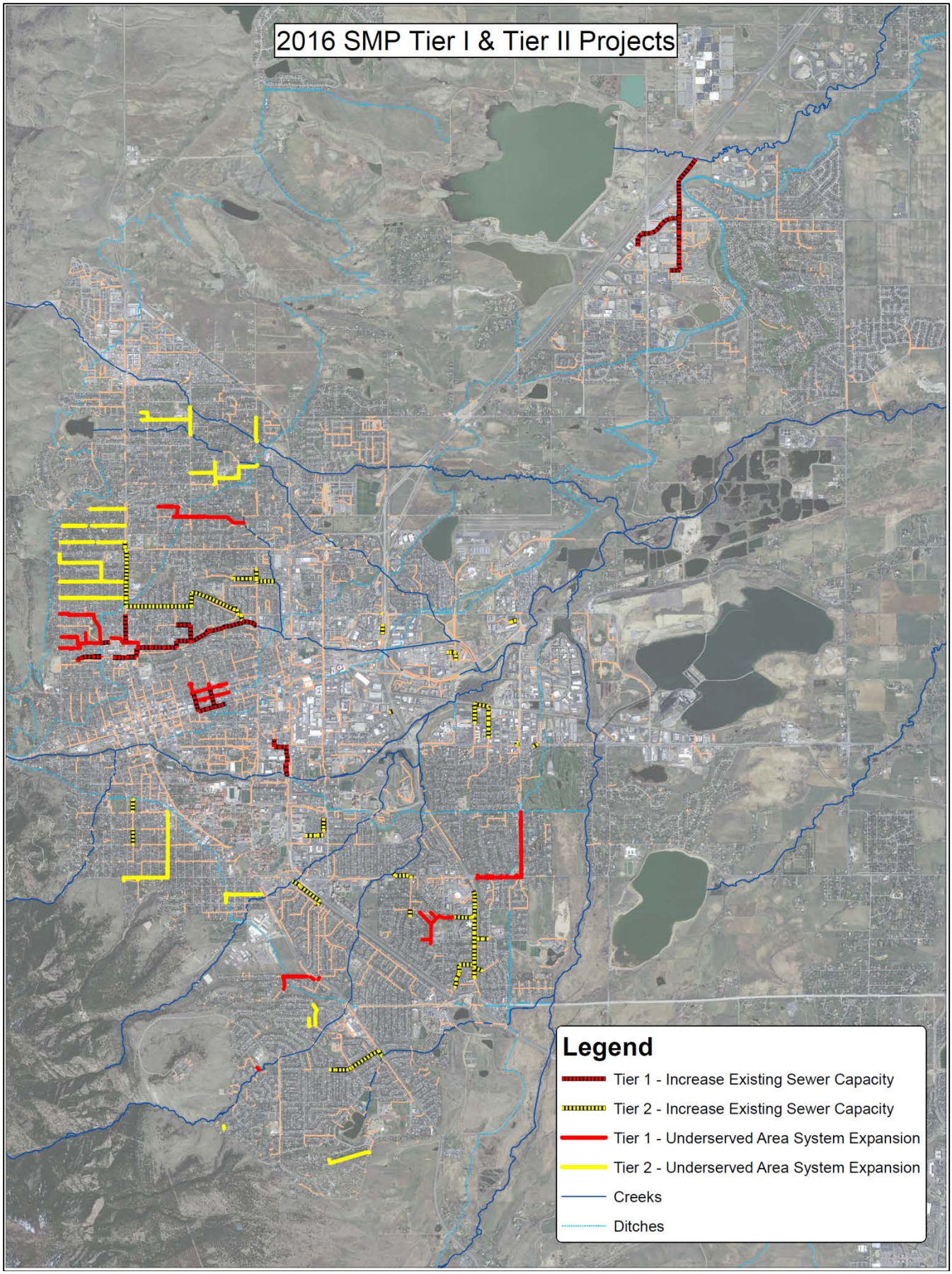


Figure 1 - 2016 SMP Tier I and Tier II Project Recommendations

CITY OF BOULDER

WATER RESOURCES ADVISORY BOARD
AGENDA ITEM

MEETING DATE: April 18, 2016

AGENDA TITLE: Information Item -- Preliminary Draft 2017-2022 Utilities Capital Improvement Program (CIP) - Water, Wastewater and Stormwater/ Flood Management.

PRESENTERS:
Jeff Arthur, Director of Public Works for Utilities
Ken Baird, Utilities Financial Manager
Annie Noble, Acting Principal Engineer for Flood and Greenways
Douglas Sullivan, Acting Principal Engineer for Water, Wastewater and Stormwater

EXECUTIVE SUMMARY:

As part of the city's annual budget process, Utilities develops a six-year planning budget, this year for the time period of 2017 through 2022. The Water Resources Advisory Board (WRAB) role in this process is defined in the Boulder Revised Code: ". . . to review all environmental assessments and capital improvements conducted or proposed by the utilities division." Within the budget process, City Council approves and appropriates funds only for the first year, 2017.

This agenda item provides an opportunity for the WRAB to discuss early staff recommendations for changes to the CIP. Last year's CIP is included for reference as **Attachment A**. Input from WRAB will guide staff in preparation of a draft CIP for discussion by WRAB at the May meeting. WRAB will be asked to make a recommendation to City Council regarding the 2017-2022 CIP at its June meeting. The Planning Board will review the complete city CIP, including utilities, in July. City Council generally plans for two study sessions in September, prior to adopting the 2017 budget.

Fiscal Impacts: Last year's budget process resulted in increased investment in Utilities infrastructure with 2016 rate increases of 8% in Water, 5% in Wastewater and 4% in Stormwater/flood Management. Future rate increases were also identified to maintain this level of service, and for 2017 the projected rate increases were 8% in Water, 5% in Wastewater and 8% in Stormwater/Flood Management.

Public Feedback: A public hearing and recommendation is scheduled for the June WRAB meeting. At the June meeting, staff will request that the WRAB provide a final recommendation on the proposed 2017-2022 CIP to City Council and associated rates changes.

BACKGROUND and ANALYSIS:

CIP projects are any major projects requiring the expenditure of public funds (over and above operation expenditures) for the purchase, construction, or replacement of the physical assets of the community. Projects are typically over $50,000 in total project cost, and result in a durable,

long lasting asset, with a useful life of at least 15 years. Capital Improvement Program projects are divided into five categories:

- Capital Enhancement - result in the expansion or significant improvement of an existing facility or asset.
- Capital Maintenance - result in the repair, replacement, or renovation of an existing asset with a useful life of at least 5 years.
- Capital Planning Studies - result in the development of a study or plan which is intended to identify, plan, or prepare for the construction or acquisition of capital assets or capital program.
- Land Acquisition - result in the acquisition of real property, such as land, mineral or water rights, or permanent easements.
- New Facility or Infrastructure – result in the construction or acquisition of a new asset or additional square footage of an existing asset.

The city developed nine CIP Guiding Principles to create a city wide understanding of which projects are chosen to be included in the CIP and shape capital planning decisions made throughout the CIP process. The CIP Guiding Principles also ensure individual department priorities for CIP funding are aligned with city goals. The CIP Guiding Principles are included as **Attachment B.**

During the annual CIP and budget process, individual projects are identified as requiring a Community and Environmental Assessment Process (CEAP). The purpose of the CEAP is to assess potential impacts of conceptual project alternatives in order to inform the selection and refinement of a preferred alternative. The CEAP provides the opportunity to balance multiple community goals in the design of a capital project by assessing a project against the policies outlined in the Boulder Valley Comprehensive Plan (BVCP) and departmental master plans. The criteria for projects requiring a CEAP include a project that could have: significant impact on an environmental, social or cultural resource; community controversy; more than one possible alternative or a requirement of internal or external permitting. All CIP projects are reviewed by an inter-departmental staff group to determine whether a CEAP will be required.

The Utilities Division's primary focus is to provide quality water services, as desired by the community, in a manner which emphasizes efficient management of fiscal and natural resources, and protects human and environmental health. Each of the city's three utilities (water, wastewater and stormwater/flood management) is a separate enterprise fund established to finance and account for the acquisition, operation and maintenance of each utility's facilities and services while maintaining designated reserves and meeting debt service requirements.

Revenues generated from monthly utility bills are the largest source of revenue for each utility, in 2015 accounting for about 68% of revenues in the Water Fund, 80% in the Wastewater Fund, and 80% in the Stormwater/Flood Management Fund. Other significant sources of funds include development fees (Plant Investment Fees), hydroelectric revenues, funding from the Urban Drainage and Flood Control District (UDFCD) and interest earnings.

Approximately fifty-five percent of the Utilities expenditures are allocated for rehabilitating and improving the capital infrastructure either through the capital improvements program (cash financed) or through annual debt payments for revenue bonds that have been issued to fund capital improvements. Maintaining existing infrastructure is critical to delivering safe and reliable services to our customers. Investment into maintenance of existing infrastructure is less costly in the long run. Other significant uses of funds include water treatment operations, wastewater treatment operations, system maintenance and water quality operations.

Utility Rates

Last year's budget process anticipated the following rate increases for 2017: 8% Water, 5% Wastewater, and 8% Stormwater/Flood Management. In the early stages of budget planning, the projected increase in the wastewater fund appears sufficient to keep pace with construction cost escalation and maintain service levels. In the water fund there are areas where funding increases may be warranted beyond what was projected last year. This includes community and Council interest related to the water distribution system and water main breaks, and continuing investment in aging infrastructure. In the stormwater/flood management fund, the continuing condition assessments on the stormwater system and completing an update to the Stormwater Collection System Master Plan will help further clarify needs. Identified stormwater collection system improvements and flood mitigation along major drainageways significantly exceed current funding levels and will need to be completed over many decades unless there is community support for increased investment.

Utility Bill Comparisons

Estimated single-family residential annual bills for the City's current and 2017 assumed (8%-5%-8% increases) rates are compared with other Colorado Front Range communities. **Attachment C** shows the water bill comparison, and an 8% Water increase puts Boulder in the middle for single-family residential bills. The bill comparison for a 5% increase in the Wastewater Utility is shown in **Attachment D**, and Boulder's position compared to the other Cities moves from up one spot to 5th highest. **Attachment E** shows the Stormwater/Flood annual bill and the impact of an 8% increase, which remains the highest of the group. With it numerous drainageways, topography, and proximity to the foothills, the City of Boulder has the highest flood risk for any municipality in the State of Colorado. Since 2017 rate proposals are not yet available for the other cities, the survey uses their 2016 rates.

A fourth chart, **Attachment F** shows the annual bill comparison when all three utility fees are included. If other Front Range communities surveyed do not increase rates for 2017, Boulder's combined rates would remain the fifth highest of the fifteen. Also included as **Attachment G** is a Water utility bill comparison of different cities in the Western United States for the last year the consolidated data was available, which was 2015.

Customer Bill Impact

The proposed preliminary 2017 revenue increases (8%-5%-8%) would increase a typical residential customer's monthly utility bill by $5.90, or an increase of $70.80 annually. The following table provides a breakdown of the potential increases by utility.

Table 3 – Average Monthly Bill Impacts

	Monthly Bill 2016 Rates	Monthly Bill 2017 Rates	Monthly Difference
Water	$39.57	$42.73	$3.16
Wastewater	$31.75	$33.37	$1.62
Stormwater/ Flood Mgmt	$14.00	$15.12	$1.12
Total	**$85.32**	**$91.22**	**$5.90**

Impact of Rate Changes

The impact of a 1% increase in revenue varies substantially across the three funds:

Table 4–Rate Impact	1%	2%	3%
Water	$250,000	$500,000	$750,000
Wastewater	$200,000	$400,000	$600,000
Stormwater / Flood Mgmt	$ 100,000	$200,000	$300,000

Additional information about other customer classes and cost comparisons will be provided as part of the staff presentation. As a point of reference, $100,000 provides for debt service coverage on a bond of approximately $1,000,000.

Grant and Other Funding Opportunities

While funding for utility capital projects is primarily through rate and PIF revenue, the city has taken advantage of opportunities for outside or grant funding. In recent years the utilities have received grant funding the majority of which can be categorized in some broad areas – disaster related, resilience, and regulatory. Following the 2013 flood disaster, the city became eligible for federal assistance through the Federal Emergency Management Agency (FEMA). When final FEMA reimbursements are disbursed, the utilities funds will have received over $6 million, primarily in the Stormwater/Flood Management Fund. After this flood, additional city staff was hired to help manage the FEMA reimbursement process and also pursue other grant opportunities. Recently the city entered into an agreement to receive over $2.4 million from the Department of Urban Development for Community Development Block Grant – Disaster Recovery (CDBG-DR) funds for the Wonderland Creek project. These funds were awarded because the project meets the goals of the grant by reducing flood related hazards for vulnerable populations located in project areas. The city was also awarded $215,000 from a CDBG-DR grant which will fund a program for home recovery and resilience assessments. Additionally, in response to the flood disaster the city received grant funding from the State of Colorado for recovery efforts. While outside funding to help with regulatory mandates is generally rare, the Wastewater Fund recently received over $1 million from the State to help with a current project.. Finally, the city was awarded grants from the Department of Energy for a prior project related to upgrades at the Boulder Canyon Hydroelectric facility, and also a current project for resilience improvements to the Boulder Reservoir Water Treatment Facility.

Federal funds for direct grants to utilities tend to be rare until infrastructure or treatment processes reach a point of being a critical public health concern. Much of the Federal funding for utility infrastructure has gone to support State revolving loan programs. Colorado's State Revolving Fund Loan Program can provide direct loans for projects up to $2.5 million and leveraged loans for projects greater than $2.5 million. These loans have interest rates that are comparable to AAA rated issues. Project loan requests from various utilities throughout the state exceed the funds available, so projects are evaluated using a scoring model. The scoring tends to favor smaller systems with populations under 10,000, with public health concerns, and especially those with relatively low median household incomes. Boulder being a relatively large and affluent community is less likely to be awarded funds. Loans from the revolving fund also come with stipulations and reporting requirements similar to a grant, which adds administrative costs. While issuance of bonds is generally the most cost effective approach for the city to fund major capital projects, Utility staff will continue to monitor other funding opportunities to determine if they would be advantageous to pursue. In some cases, administrative requirements and conditions (such as Davis-Bacon wages), can increase overall project costs to the point that the benefit of the grant is negated.

CAPITAL IMPROVEMENT PROGRAM

The following information is provided to highlight initial considerations for changes to the previous CIP in each fund.

Water Utility

The draft CIP includes funding for the Boulder Reservoir Water Treatment Facility, which requires improvements to the filter media, valves, electrical, backup power, and various site improvements. The electrical and backup improvements may be completed in conjunction with a resiliency grant project early in the 6-year CIP. The remaining work will be completed in the last four years of the CIP. The Barker gravity pipe line will be funded to continue the annual rehabilitation of this 100-year old asset. New funding will be required for the Water Transmission line program to address rehabilitation of the City's large diameter high pressure water mains. The water distribution line program will continue to be funded to address aging small diameter water mains. Based on recent community and City Council interest in distribution main water breaks, there may be a desire to accelerate this program through the budget process. The Devils Thumb storage tank will require improvements associated with painting & structural steel and concrete rehabilitation is necessary at Chautauqua reservoir. Additional information about the Carter Lake Pipeline is provided as Attachment G in response to WRAB questions at the March 28 meeting.

Wastewater Utility

The draft CIP includes funding for the annual wastewater collection system inspection and rehabilitation programs. The inspection program involves the cleaning and TV inspection of the sanitary sewer pipes to identify various system deficiencies and to prioritize their rehabilitation

needs. The rehabilitation program involves the lining or replacement of the sanitary sewer pipes to ensure their structural integrity, increase the hydraulic capacity when possible, and to extend their useful life.

The CIP includes funding for the Wastewater Collection System Master Plan (WWCSMP) Update's recommended projects. The WWCSMP Update includes a reprioritization of projects identified in the previous 2009 master plan, and incorporates flood inundation data collected from the September 2013 flood event.

The CIP includes funding for rehabilitation of the system's larger diameter sanitary sewers. The City secured a $10,000,000 bond in 2015 which was used to fund sanitary sewer rehabilitation and the Wastewater Treatment Facility Nutrient project. This freed up fund balance to fund the rehabilitation of the system's large diameter sanitary sewers which were found to have extensive internal corrosion.

The Wastewater Treatment Facility (WWTF) has several key projects identified in the 6-year CIP. The first project is necessary to address Regulation 85 requirements that mandate more stringent CDPHE effluent discharge regulations specific to phosphorus. The second project involves rehabilitation to the facility's secondary digester. These projects have funding for design, construction and construction management services in years 2019 through 2021.

Stormwater and Flood Management Utility

The city has a comprehensive flood management program designed to identify flood risks along the major drainageways, reduce those risks, minimize loss of life and property damage, and support recovery following major flood events. The overall process for meeting these objectives includes: updating the Flood Insurance Rate Maps (FIRMs), developing mitigation plans to identify feasible opportunities to reduce the risk of flooding and programming flood mitigation projects into the CIP.

As a result of the September 2013 flood, funding was added in the 2015-2020 CIP as a placeholder for the design and construction of improvements along the various drainageways in anticipation of completing mapping studies and mitigation plans. Since last year's CIP was developed, flood mitigation plans have been completed for Gregory Creek, Boulder Creek and South Boulder Creek.

Flood mitigation plans are currently being developed for the following creeks:

- Bear Canyon Creek
- Upper Goose Creek and Twomile Canyon Creek

In anticipation of completing a flood mapping study this year, a flood mitigation plan will be initiated in 2017 for:

- Skunk Creek, (includes Bluebell Canyon Creek and King's Gulch)

Based on approved flood mitigation plans and estimates for Bear, Skunk, Twomile, Upper Goose and Sunshine Creeks, $160 million of major drainageway improvements have been identified. These improvements vary from addressing the 10-year storm event to constructing 100-year improvements. The near term funding in the 2017-2022 CIP focuses on completing improvements along Fourmile Canyon Creek between Broadway and 22nd Street and constructing the first phase of the South Boulder Creek Flood Mitigation Plan. In 2018, funding is proposed for improvements along Skunk and Twomile Canyon Creeks, with a proposed funding shift from Bluebell/King's Gulch to Gregory Creek and in the later years from Fourmile Canyon Creek to Upper Goose Creek.

Improvements along Fourmile Canyon Creek were identified in the flood mitigation plan in 2011 and provide safe access to Crest View Elementary School. Last year's CIP included a total of $5.25 million over the 6-year period. Funding previously shown in 2017 and 2018 ($5M) for Boulder Creek is shown to be moved in this year's CIP to Fourmile Canyon Creek in order to complete these projects sooner. Funding that was shown in last year's CIP for Fourmile Canyon Creek in 2019-2022 is proposed to be moved to Goose Creek to coordinate with localized drainage improvements between 19th Street and Folsom. Based on the 2015 mitigation plan and consistent with last year's CIP, funding for the first phase of the South Boulder Creek improvements (a regional detention facility upstream of US 36) continues to be shown as bonded in 2018.

Below is a list of the schedule for each drainageway shown in the CIP and the changes in funding levels from the 2016-2021 CIP to 2017-2022 CIP.

Status and Funding Changes for the Major Drainageway Projects

Drainage	Mapping Study	Mitigation Plan to Council	Funding Planned	Changes from 2016-2021 to 2017-2022
Bear Canyon	Updated	4th Quarter 2016	2015, 2016	none
Gregory	Updated	December 2015	2015, 2016, 2018	Shifted $500K from Bluebell
Boulder Creek	Submitted to FEMA	January 2016	2018	Shifted $3.5M to Fourmile,
Skunk, Bluebell, King's Gulch	Anticipate to submit 3rd Quarter 2016	Initiate in 2017	2017, 2018	Shift $500K to Gregory
Upper Goose, Twomile	Submitted to FEMA in October, 2015	Initiate in 2016	2017-2022	Shifted $3.25M from Fourmile to Upper Goose
South Boulder Creek	updated	August 2015	2018	none
Fourmile - 19th to 22nd	updated	2009	2015	Combine with upstream improvements
Fourmile upstream of 19th (Upland to Violet)	updated	2009	2016-2018	Shifted $3.5M from Boulder Creek

The CIP also includes funding for the annual stormwater collection system condition assessment and rehabilitation programs. The condition assessment program involves the cleaning and TV inspection of the storm sewer pipes to identify various system deficiencies and to prioritize their rehabilitation needs. The rehabilitation program involves the lining or replacement of the storm sewer pipes to ensure their structural integrity, increase the hydraulic capacity when possible, and to extend their useful life.

The CIP includes funding for the Stormwater Master Plan (SMP) Update's recommended projects. The SMP Update includes a reprioritization of projects identified in the previous 2007 master plan as well as an expanded list of new projects for areas of the City underserved with storm sewer infrastructure. The SMP Update incorporates flood inundation data collected from the September 2013 flood event. The highest priority project identified in the 2007 SMP was the Upper Goose Creek Basin – located between 9th and 19th streets in North Boulder. This project remains the highest priority identified in the current SMP Update, and may also include additional storm sewer infrastructure into underserved areas to the west of 9th Street.

RATE STUDIES

Staff is in the early stages of conducting a review of the Utility rate study. It has been over nine years since comprehensive rate studies have been completed for the Water, Wastewater, or Stormwater/Food Utilities. The focus of the study is on rate structure and allocation of costs across customers and is not an analysis of revenue requirements or capital needs. The results of this rate study will inform any adjustments for 2017 budget development.

BUDGET SCHEDULE:

The current schedule of major budget milestones is provided below. Elements involving the WRAB are highlighted in bold italics.

Milestone	Date
CIP WRAB Discussion	***April 18, 2016***
Budget Guidelines to Departments	April 18, 2016
WRAB meeting – review Draft CIP	***May 16, 2016***
Proposed Budget Submittal to City Manager	May 31, 2016
WRAB Recommendation on CIP/Budget	***June 20, 2016***
Planning Board CIP Hearing	July 28, 2016
City Council Study Session on Budget (CIP)	Aug. 9, 2016
City Council Study Session on Budget	Sept. 13, 2016
City Council Study Session on Budget (if needed)	Sept. 27, 2016
City Council Consideration/Adoption of Budget	Oct. 4 and Oct. 18, 2016

NEXT STEPS:

Staff is seeking feedback on the 2017 CIP changes and potential rate impacts. This feedback will be considered by staff in developing a draft CIP for WRAB discussion at the May 16, 2016 meeting. At the June 20, 2016 WRAB meeting, staff will request that WRAB provide a final recommendation concerning the proposed 2017-2022 CIP to Planning Board and City Council.

Attachments:
A: 2016-2021 Utilities CIP
B: CIP Guiding Principles
C: Colorado Utility Bill Comparison – Water
D: Colorado Utility Bill Comparison – Wastewater
E: Colorado Utility Bill Comparison – Stormwater/Flood Management
F: Colorado Utility Bill Comparison – Combined Utilities
G: 2015 Western U.S. Bill Comparison - Water
H: Carter Lake Pipeline Information

Attachment A

	A	K	L	M	N	O	P
1				CITY OF BOULDER			
2				2016-2021 CAPITAL IMPROVEMENT PROGRAM			
3				WATER UTILITY FUND			
4							
5							
6	**Assumed Inflation Rate**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
7	**PROJECT NAME**	**APPROVED**	**PROJECTED**	**PROJECTED**	**PROJECTED**	**PROJECTED**	**PROJECTED**
8	**F**						
9	**Treated Water Pressure Reducing and Hydroelectric Facilities**						
12	Orodell Hydro/PRV Facility	$75,000	$0	$0	$0	$0	$0
13	Sunshine Hydro/PRV Facility	$0	$271,875	$0	$0	$0	$0
14	Pearl Street Hydro/PRV Facility	$0	$0	$24,333	$243,331	$0	$0
15	**Subtotal - Treated Water PRV and Hydro**	$75,000	$271,875	$24,333	$243,331	$0	$0
16							
17	**Water Treatment Facilities**						
18	Betasso WTF	$900,000	$0	$0	$0	$0	0
19	Betasso WTF - Bond Proceeds	$24,000,000	$0	$0	$0	$0	$0
20	Bond Issuance Costs	$240,000	$0	$350,000	$0	$100,000	$0
21	Boulder Reservoir WTF	$314,000	$0	$0	$0	$2,000,000	$0
22	Boulder Res WTF - Bond Proceeds	$0	$0	$0	$0	$0	$0
23	**Subtotal - Water Treatment Facilities**	$25,454,000	$0	$350,000	$0	$2,100,000	$0
24							
30							
31	**Treated Water Storage Tanks**						
36	Kohler Storage Tank	$799,875	$0	$0	$0	$0	$0
37	Chautauqua Storage Tank	$0	$0	$0	$0	$0	$0
38	Betasso Storage Tank	$0	$292,465	$0	$0	$0	$0
40	**Subtotal - Treated Water Storage Tanks**	$799,875	$292,465	$0	$0	$0	$0
41							
42	**Treated Water Distribution System**						
45	Waterline Replacement	$3,352,960	$3,487,078	($0)	$3,771,624	$3,922,489	$4,079,389
46	**Subtotal - Treated Water Distribution Systen**	$3,352,960	$3,487,078	($0)	$3,771,624	$3,922,489	$4,079,389
47							
48	**Treated Water Transmission System**						
52	Zone 1 Transmission Pipes	$0	$0	$250,000	$0	$0	$250,000
53	Zone 2 Transmission Pipes	$0	$250,000	$0	$0	$250,000	$0
54	Zone 3 Transmission Pipes	$1,200,000	$0	$0	$250,000	$0	$0
55	**Subtotal - Treated Water Transmission Syste**	$1,200,000	$250,000	$250,000	$250,000	$250,000	$250,000
56							
57	**Source Water Transmission System**						
58	Lakewood Pipeline	$0	$0	$0	$316,330	$0	$0
61	**Subtotal - Source Water Transmission Syste**	$0	$0	$0	$316,330	$0	$0
62							
63	**Barker Water System**						
64	Barker Gravity Pipeline Repair	$667,416	$1,169,859	$1,216,653	$1,265,319	$1,315,932	$1,368,569
65	Barker-Kossler Penstock Repair	$0	$116,986	$0	$0	$0	$0
66	Barker Dam Outlet	$100,000	$175,000	$0	$835,551	$0	$0
67	Barker Dam Outlet - Bond Proceeds	$0	$0	$0	$0	$8,355,509	$0
68	Barker Dam and Reservoir	$65,000	$50,000	$0	$0	$0	$0
74	Kossler Dam	$75,000	$0	$0	$0	$0	$0
75	**Subtotal - Barker Water System**	$907,416	$1,511,844	$1,216,653	$2,100,870	$9,671,441	$1,368,569
76							
77	**Raw Water Storage Reservoirs**						
78	Albion Dam	$125,000	$0	$341,636	$3,416,361	$0	$0
79	Silver Lake Dam	$0	$0	$100,000	$0	$0	$0
80	Island Lake Dam	$0	$0	$50,000	$0	$0	$0
82	Green Lake 2 Dam - Bond Proceeds	$0	$0	$0	$0	$0	$0
83	Green Lake 2 Dam	$0	$0	$0	$0	$75,000	$486,773
85	Goose Lake Dam	$0	$0	$75,000	$0	$0	$0
86	Boulder Reservoir	$50,000	$0	$0	$0	$118,434	$0
87	Lakewood Dam	$0	$0	$124,707	$0	$0	$0
88	Skyscraper Dam	$0	$0	$0	$0	$0	$171,071
89	Wittemyer Ponds	$0	$0	$0	$100,000	$492,685	$4,926,849
90	**Subtotal - Raw Water Storage Reservoirs**	$175,000	$0	$691,343	$3,516,361	$686,119	$5,584,692
91							
92	**Other Raw Water Facilities**						
93	Farmer's Ditch	$0	$0	$0	$108,160	$0	$0
95	Source Water Facilities Rehab Program	$150,000	$150,000	$150,000	$150,000	$150,000	$150,000
96	Watershed Improvements	$80,000	$0	$0	$0	$100,000	$0
103	NCWCD Conveyance - Carter Lake Pipelin	$850,000	$2,036,322	$0	$0	$0	$0
104	NCWCD Conveyance/Waterline replaceme	$0	$0	$37,565,263	$0	$0	$0
105	**Subtotal - Other Raw Water Facilities**	$1,080,000	$2,186,322	$37,715,263	$258,160	$250,000	$150,000
106							
107	**Source Water Pressure Reducing, Pumping and Hydroelectric**						
108	Lakewood Hydroelectric/PRV	$130,000	$0	$0	$300,000	$0	$0

Attachment A

	A	K	L	M	N	O	P
1				CITY OF BOULDER			
2				2016-2021 CAPITAL IMPROVEMENT PROGRAM			
3				WATER UTILITY FUND			
4							
5							
6	**Assumed Inflation Rate**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
7	**PROJECT NAME**	**APPROVED**	**PROJECTED**	**PROJECTED**	**PROJECTED**	**PROJECTED**	**PROJECTED**
8	**F**						
109	Silver Lake Hydroelectric/PRV	$25,000	$50,000	$80,000	$0	$0	$0
110	Boulder Reservoir Intake and Pumping	$0	$0	$0	$0	$0	$0
111	Betasso Hydroelectric / Pressure Reducing	$0	$380,000	$480,000	$0	$0	$0
112	Barker Dam Hydroelectric	0	$0	$0	$0	$0	$0
113	Barker Dam Hydro	$0	$0	$0	$0	$0	$0
117	Carter Lake Hydroelectric	$0	$0	$50,000	$250,000	$0	$0
118	Carter Lake Hydro	$0	$0	$0	$0	$2,500,000	$0
119	Source Water Pressure Reducing, Pumping	$0	$0	$0	$0	$193,472	$201,210
120	**Subtotal - Source Water PRV, Pumping and**	$155,000	$430,000	$610,000	$550,000	$2,693,472	$201,210
121							
126	**Water System Monitoring and Metering**						
127	Automated Meter Reading	$0	$0	$0	$0	$0	$684,285
128	Water System Security/Quality Improvemer	$150,000	$150,000	$150,000	$90,000	$0	$0
129	Source Water Monitoring and Protection	$100,000	$100,000	$100,000	$100,000	$0	$0
134	Utility Billing Computer System	$0	$0	$0	$0	$125,000	$0
135	**Subtotal - Water System Monitoring and Met**	$250,000	$250,000	$250,000	$190,000	$125,000	$684,285
136							
137	**TOTAL CAPITAL USES OF FUNDS**	$33,449,251	$8,679,585	$41,107,591	$11,196,676	$19,698,520	$12,318,145

Attachment A

	A	K	L	M	N	O	P
1			CITY OF BOULDER				
2			2016 - 2021 CAPITAL IMPROVEMENT PROGRAM				
3			WASTEWATER UTILITY FUND				
4							
5							
6	**Assumed Inflation Rate**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
7	**PROJECT NAME**	**APPROVED**	**PROJECTED**	**PROJECTED**	**PROJECTED**	**PROJECTED**	**PROJECTED**
8							
9	**Wastewater Treatment**						
10	WWTF Pumps	$150,000	$0	$0	$0	$0	$0
11	WWTF Permit Improvements	$150,000	$0	$750,000	$1,500,000	$0	$136,857
13	WWTF Permit Improvements - Proj. Bond	$0	$0	$0	$0	$18,500,000	$0
14	WWTF Laboratory	$50,000	$0	$0	$0	$0	$0
18	WWTF Instrumentation/Control	$0	$674,918	$701,915	$729,992	$759,191	$0
19	WWTF Electrical	$120,000	$1,200,000	$0	$0	$0	$0
20	WWTF Activated Sludge	$0	$175,479	$0	$0	$0	$0
26	WWTF Rehabilitation	$0	$0	$0	$0	$150,000	$375,000
31	WWTF Cogeneration	$0	$0	$0	$0	$184,481	$0
32	WWTF Digester Complex	$0	$0	$0	$200,000	$2,000,000	$0
34	WWTF Digester Cleaning	$0	$0	$0	$0	$0	$0
35	Bond Issuance Costs	$0	$0	$0	$0	$125,000	$0
36	**Subtotal - Wastewater Treatment Plant**	$470,000	$2,050,397	$1,451,915	$2,429,992	$21,718,672	$511,857
37							
38	**Marshall Landfill**						
39	Marshall Landfill	$100,000	$0	$0	$0	$0	$0
40	**Subtotal - Marshall Landfill**	$100,000	$0	$0	$0	$0	$0
41							
42	**Wastewater System Monitoring and Metering**						
45	Utility Billing Computer System	$0	$0	$0	$0	$65,000	$0
46	**Subtotal - Monitoring and Metering**	$0	$0	$0	$0	$65,000	$0
47							
48	**Collection and Conveyance System Rehabilitation**						
50	Condition Assessment Program	$811,200	$843,648	$877,394	$912,490	$948,989	$986,949
51	Sanitary Sewer Rehabilitation	$2,758,080	$2,868,403	$2,983,139	$3,102,465	$3,226,563	$3,355,626
53	Sanitary Sewer Manhole Rehabilitation	$216,320	$224,973	$233,972	$243,331	$253,064	$657,966
56	Tier 1 Goose Creek 1/1A Master Plan Proje	$0	$0	$0	$0	$0	$329,278
58	Tier 1 Goose Creek 5 Master Plan Project	$0	$0	$25,000	$647,590	$1,346,988	$1,400,867
66	**Subtotal - Sewer System Rehabilitation**	$3,785,600	$3,937,024	$4,119,505	$4,905,875	$5,775,604	$6,730,686
67							
71							
72	**TOTAL CAPITAL USES OF FUNDS**	$4,355,600	$5,987,421	$5,571,420	$7,335,867	$27,559,277	$7,242,543

	A	I	J	K	L	M	N
1				CITY OF BOULDER			
2			2016-2021 CAPITAL IMPROVEMENT PROGRAM				
3			STORMWATER AND FLOOD MANAGEMENT UTILITY FUND				
4							
5							
6		2016	2017	2018	2019	2020	2021
7	PROJECT NAME	PROPOSED	PROJECTED	PROJECTED	PROJECTED	PROJECTED	PROJECTED
8							
9	**Major Drainageways**						
12	South Boulder Creek	$750,000	$750,000	$0	$0	$0	$0
13	South Boulder Creek - Bond Proceeds	$0	$0	$25,000,000	$0	$0	$0
14	Bond Issuance Costs	$0	$0	$325,000	$0	$0	$0
15	Skunk Canyon Creek	$0	$100,000	$500,000	$0	$0	$0
17	Twomile Canyon Creek	$0	$100,000	$500,000	$0	$0	$0
18	Bluebell Canyon Creek - King's Gulch	$0	$100,000	$500,000	$0	$0	$0
20	Four Mile Canyon Creek	$0	$0	$500,000	$1,250,000	$1,250,000	$500,000
21	Four Mile Canyon Creek - Upland to Violet	$500,000	$500,000	$500,000	$250,000	$0	$0
23	Bear Canyon Creek	$500,000	$0	$0	$0	$0	$0
24	Gregory Canyon Creek	$500,000	$0	$0	$0	$0	$0
25	Boulder Creek	$0	$2,500,000	$2,250,000	$0	$0	$0
32	Preflood Acquisition	$500,000	$550,000	$600,000	$633,000	$660,000	$684,285
33	Greenways Program Transfer	$97,500	$97,500	$97,500	$97,500	97,500	97,500
34	**Subtotal - Major Drainageway Improvements**	$2,847,500	$4,697,500	$30,772,500	$2,230,500	$2,007,500	$1,281,785
35							
36	**Miscellaneous**						
40	Utility Billing Computer System	$0	$0	$0	$0	$65,000	$0
41	**Subtotal - Miscellaneous Drainage Improvements**	$0	$0	$0	$0	$65,000	$0
42							
43	**Stormwater Management**						
44	Upper Goose Creek	$750,000	$750,000	$750,000	$1,000,000	$1,165,547	$1,221,869
45	Local Drainage Improvements	$730,080	$759,283	$789,655	$821,241	$854,090	$986,949
46	Stormwater Quality Improvements	$162,000	$169,000	$175,500	$182,500	$190,000	$197,390
47	Storm Sewer Rehabilitation	$270,400	$281,200	$292,500	$304,000	$632,700	$657,966
48	Transportation Coordination	$324,500	$337,500	$351,000	$365,000	$633,000	$657,966
49	**Subtotal - Localized Drainage Improvements**	$2,236,980	$2,296,983	$2,358,655	$2,672,741	$3,475,337	$3,722,139
50							
51	**TOTAL CAPITAL USES OF FUNDS**	$5,084,480	$6,994,483	$33,131,155	$4,903,241	$5,547,837	$5,003,924

Attachment B

CIP Guiding Principles

The City of Boulder develops a Capital Improvement Program (CIP) that addresses the ongoing major business needs and maintenance and repair of city assets as well as enhancements and expansion called for in the Boulder Valley Comprehensive Plan and city Master Plans. The CIP is a strategic document that assures that the municipal organization maintains a strong bond rating, implements community values, and has fiscal integrity. The city prioritizes its investments both across and within funds based on the following guiding principles:

1. **Capital Improvement Programs should be consistent with and implement Council-accepted master plans and strategic plans.**
2. **Capital Improvements should achieve Community Sustainability Goals:**
   - Accessible and Connected Community: improve and maintain mobility systems, infrastructure networks, and access to information
   - Economically Vital Community: provide infrastructure and amenities supporting employers and economic diversity
   - Environmentally Sustainable Community: promote natural resource and energy conservation; employ sustainable construction practices; and utilize renewable resources
   - Healthy and Socially Thriving Community: provide recreational, cultural, educational, and social opportunities that support physical and mental well-being; and facilitate inclusive community engagement
   - Livable Community: provide safe and well-maintained public infrastructure and services and enhance neighborhood livability
   - Safe Community: ensure timely response to emergencies and natural disasters; foster a climate of safety, maintaining and improving public safety and security
   - Good Governance: utilize effective and efficient use of public funds, maintaining a strong fiscal foundation; leverage external investments;

Attachment B

promote community partnerships; and promote stewardship of human, information and physical assets

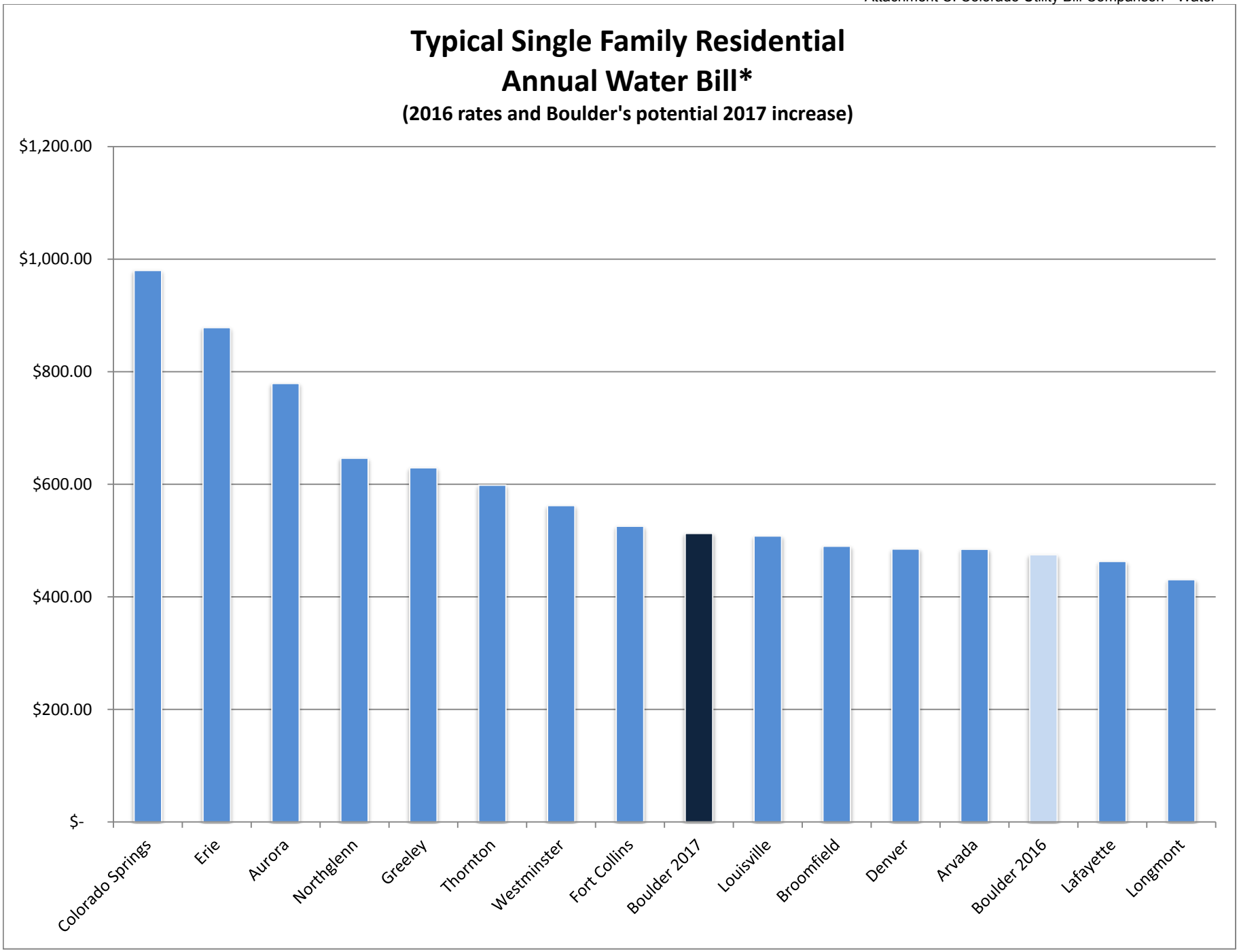
3. As potential capital investments are identified, the city must demonstrate in the CIP process that there are sufficient funds to operate and maintain the project or program.

4. Capital Improvement Programs should provide enough capacity and flexibility in our long-term planning to be able to respond to emerging, unanticipated needs.

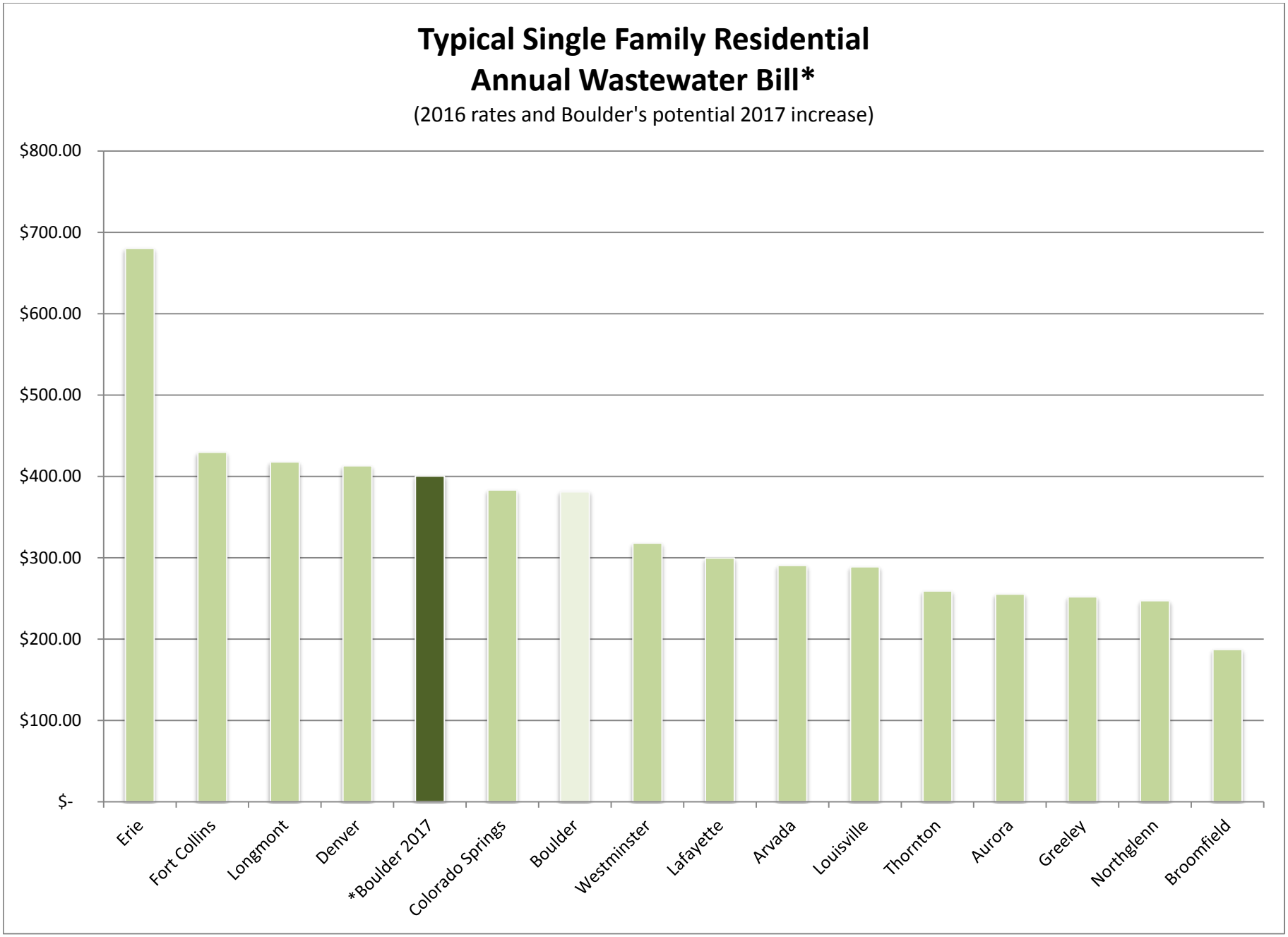
5. Capital Improvement Programs should maintain and enhance the supporting city-wide "business systems", such as information and finance systems, for the city over the long term.

6. Capital Improvement Programs should focus on capital investments for sustaining or improving maintenance of existing assets based on consistent asset assessment principles and practices, as well as balance needed investments for enhancements or new facilities to support levels of service outlined in master plans.

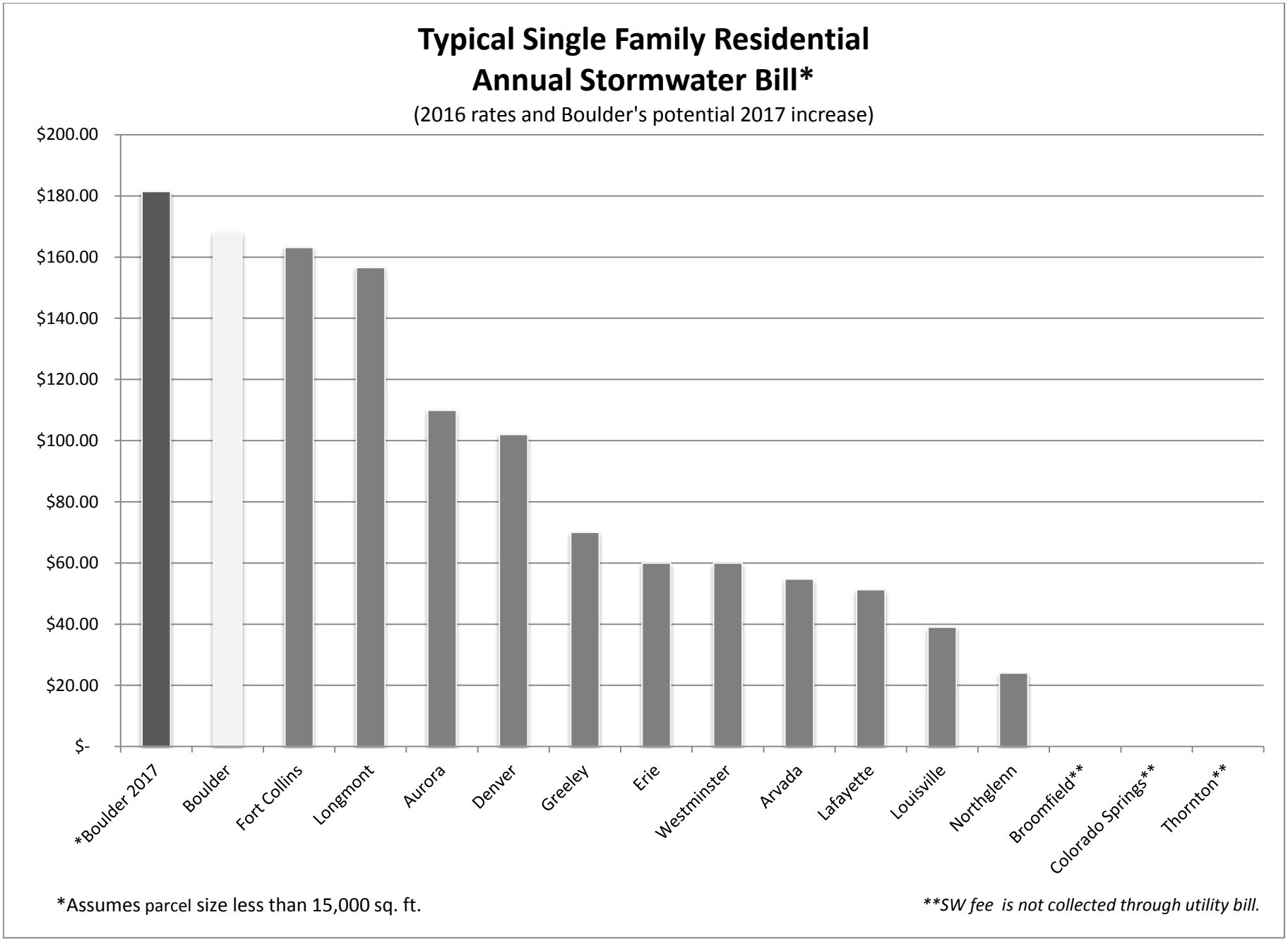
7. Capital programming should maximize efficiency of investments demonstrated by measurable cost/benefit analyses and coordination of projects across departments within and across funds.



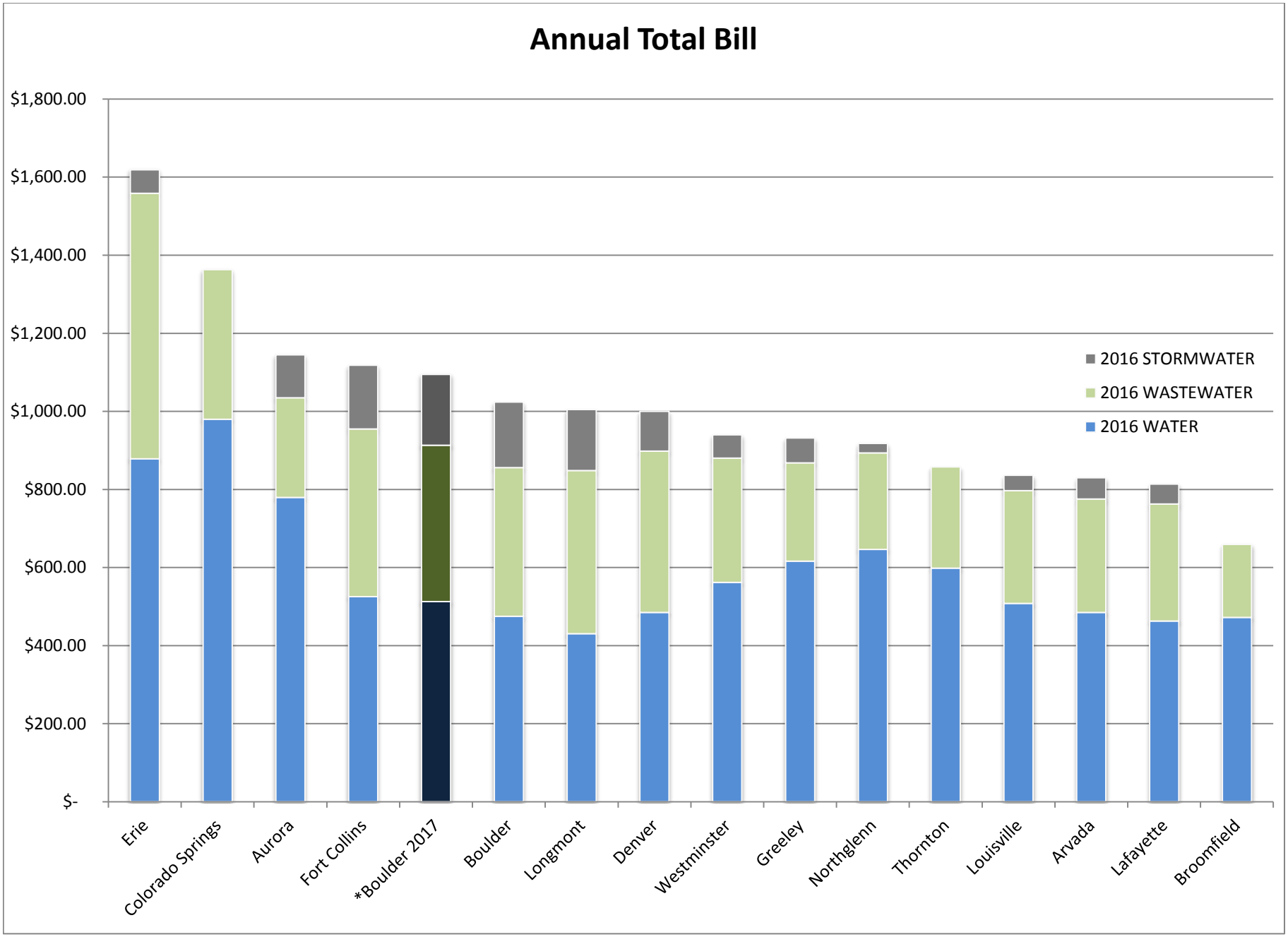
*Assumes 120,000 gal. annual use



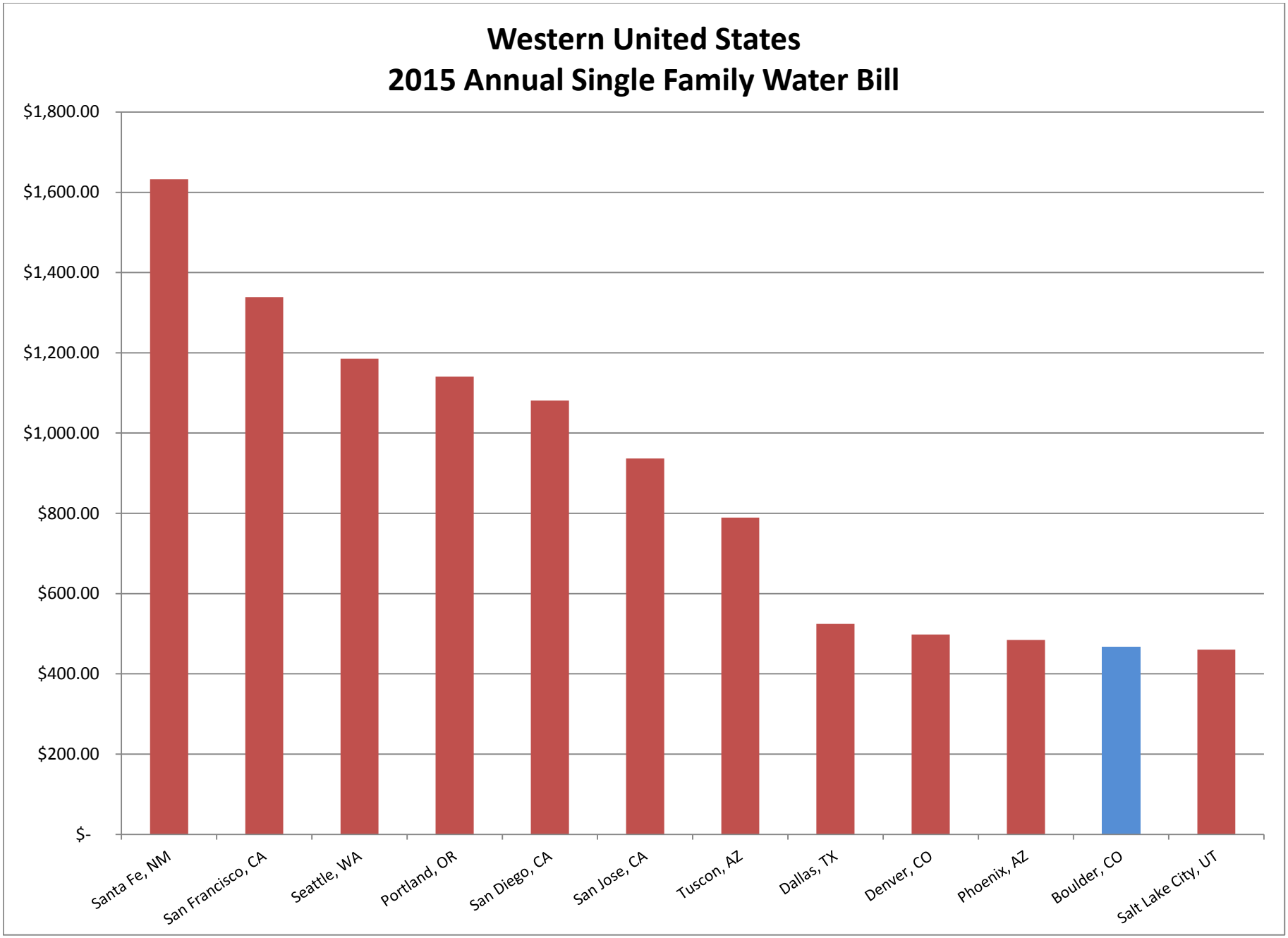
*Assumes 5,000 gallons Average Winter Consumption


Typical Single Family Residential
Annual Stormwater Bill*
(2016 rates and Boulder's potential 2017 increase)
$200.00
$180.00
$160.00
$140.00
$120.00
$100.00
$80.00
$60.00
$40.00
$20.00
$-
*Boulder 2017
Boulder
Fort Collins
Longmont
Aurora
Denver
Greeley
Erie
Westminster
Arvada
Lafayette
Louisville
Northglenn
Broomfield**
Colorado Springs**
Thornton**
*Assumes parcel size less than 15,000 sq. ft.
**SW fee is not collected through utility bill.

Attachment F

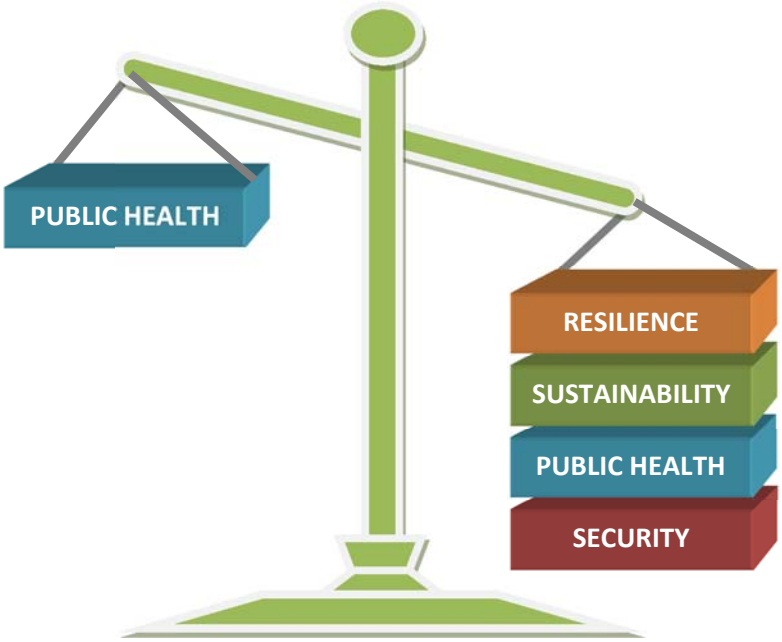


Attachment G



WATER TREATMENT PLANT IMPROVEMENTS

CARTER LAKE PIPELINE



$28M Capital Cost

~25 year life cycle (major components)
$72 million life cycle cost

$35M Capital Cost

~100 year life cycle
$46 million life cycle cost

RESILIENCE - A pipeline would significantly improve Boulder's ability to respond to system shocks or stressors and would reduce or eliminate water supply interruptions resulting from flood, wild land fire, system failure and other disasters.

SUSTAINABILITY - A pipeline would better support the city's environmental, social and economic goals by reducing energy and chemical consumption and costs associated with delivery and treatment. A pipeline would provide more consistent water to residents, businesses and industries. A pipeline is also in alignment with Boulder Valley Comprehensive Plan guidance that states, "…*priority will be placed on pollution prevention over treatment*".

PUBLIC HEALTH - A pipeline would protect public health by preventing the introduction of natural and man-made pollutants to source water during deliveries to the treatment plant. Improved source water quality reduces exposure to chemicals, pharmaceuticals and other contaminants that can persist in treated drinking water.

SECURITY - A pipeline would protect the water supply from intentional or accidental contamination risks.

Carter Lake Pipeline Financial Considerations

ITEM	DESCRIPTION
1. Life Cycle Costs	The life cycle costs of the pipeline and treatment process upgrades required to achieve similar water quality are as follows: Carter Lake Pipeline / Treatment Process Upgrades Expected Life: 100 years / 25 years[1] Capital Cost: $35,000,000 / $28,000,000 Annual O&M Cost: $158,000 / $925,000 **Life Cycle Cost: $46,000,000 / $72,000,000**
2. Avoided Cost	If Boulder ever lost the ability to treat water at both treatment plants as almost occurred during the 2013 flood, the impacts to the community would be significant. Some of the social, political and economic consequences would be severe and in some cases irreversible. Essential services such as hospitals and fire protection and businesses such as restaurants and many large commercial operations cannot function without water. According to a CH2M estimate (memo attached), the economic impact of a one month outage could be as much as $186,000,000. Dividing this outage cost by the life cycle cost of the pipeline results in a benefit-cost ratio of 4.

[1] Assumes 25% replacement (major components) would be required at the end of each 25 years.

City of Boulder
P.O. Box 791
1739 Broadway
Boulder, CO 80306

April 8, 2016

Subject: City of Boulder, CO Water Outage Analysis

Background

The City of Boulder, CO (herein referred to as "City") has requested CH2M provide an estimate of the economic impact on the City in the event of a 30-day water outage, that is, if the City's water supply were interrupted or otherwise adversely affected such that the City could not supply potable water to its entire service area for a 30-day period. Per direction from the City, a representative high-demand month (August) was assumed.

This analysis is focused on water service only, and does not address wastewater service or any other aspects of the City's operations or services.

Per the City's request, this analysis was prepared on a very short timeframe (3 days), and is therefore necessarily based on a number of assumptions and industry standards as noted in the body of this letter. This is intended to provide the City with order-of-magnitude estimates, and is not intended to take the place of a detailed regional economic analysis. The City provided CH2M with basic service area and water demand information for this work, but no interviews, workshops, data validation, scenario analysis, coordination with other City departments or stakeholders, or other activities that might be involved in a more detailed analysis were conducted. The City may elect to follow up with such a study if desired following review of this analysis.

Methodology

To meet the City's needs for this analysis, CH2M identified three methodologies that incorporate the information and data provided by the City, as follows:

- Method 1: FEMA industry standard estimation of service area economic impact of a water service outage.
- Method 2: Water service loss cost estimation, based on the "Consequence Analysis" step of the American Water Works Association (AWWA) J100 Vulnerability Assessment (VA) method (Risk Analysis and Management for Critical Asset Protection [RAMCAP(R)]) (Note: the J100 method is based on developing overall risk scores, which also take into account event likelihood and vulnerability. Specifically, J100 prescribes a step-wise method to evaluate risk based on the risk equation. Risk is based on identification of critical facilities and assets, applicable threats, worst-reasonable-case consequences, physical vulnerabilities at the critical assets, and the likelihoods associated with the selected threats. Risk = Consequence (C) x Vulnerability (V) x Threat

Likelihood (T). To meet the City's purposes for this analysis, CH2M attempted to extract the consequence estimation step from the larger VA risk-based analysis of J100.)

Upon completing initial work with this method, CH2M did not proceed further. This was because using the consequence step out of context of the overall risk analysis and basing the consequences on hypothetical water utility revenue losses as is done in J100 for individual threat-asset pairs was observed to be overly conservative for the City's entire-service-area purposes and not consistent with the other two methods presented in this analysis, which are more geared towards the City's possible scenario. Specifically, the total consequence was estimated at $4.8B assuming complete water service loss to the City of Boulder, CO (based on 100% of 40-MGD capacity shut down for 30 days).

- Method 3: Utility and service area-specific revenue loss financial analysis, based on that used for the U.S. EPA *Water Security Initiative: System Evaluation of the Cincinnati Contamination Warning System Pilot*, August 2011 (Appendix B.3).

As noted above, this analysis uses current industry standards and presents three methods for developing the order-of-magnitude estimation desired by the City under a short timeframe, but is not a detailed site-specific economic analysis. This analysis uses high-level estimates provided by the City, adaptations of industry-standard cost estimation methods, and supplemental information available from the U.S. Census Bureau and other resources, and is therefore appropriate for the City's current purposes.

Method 1: FEMA Water Outage Economic Impact

The FEMA methodology estimates water service outage economic impact based on industry standards for loss per capita per day of water outage, multiplied by the service area population.

Population served in Boulder, CO: 103,166 (US Census Bureau, 2013)

Table 1 lists the FEMA estimation of the impact on economic activity per capita per day using Gross Domestic Product (GDP) data and Applied Technology Factors (ATC). This table breaks down industry GDP into 18 economic sectors and assigns a water importance factor to each sector. By dividing the total GDP from each economic sector by the population of the US, and multiplying by the water importance factor, FEMA arrives at an economic impact factor for water outages on a per capita per day basis for each economic sector.

The sum of all of the industry sectors represents the value FEMA uses for the economic impact of water outages on industry, which is the first of two parts of their prescribed total $103/capita/day value. Year 2010 values were assumed to be sufficiently representative of current conditions for the purposes of this analysis.

Table 1: Loss of Water Service Impact to Economic Activity

Economic Sector[1]	Water Service Importance Factor[1]	GDP 2010 (in millions of dollars)[2]	GDP per Capita per Day[3]	Economic Impact per Capita per Day of Lost Service in 2010 Dollars
Agriculture, Livestock	n/a			
Mining	n/a			
Construction	0.50	$505,557	$4.486	$2.24
Manufacturing - Nondurable Goods[4]	0.60	$756,346	$6.712	$4.03
Manufacturing - Durable Goods[5]	0.70	$961,179	$8.529	$5.97
Transportation, Warehousing	0.20	$406,520	$3.607	$0.72
Utilities	0.40	$275,659	$2.446	$0.98
Wholesale Trade	0.20	$807,668	$7.167	$1.43
Retail Trade	0.20	$862,815	$7.656	$1.53
Real Estate, Rental, Leasing	0.20	$1,858,542	$16.492	$3.30
Finance, Insurance	0.20	$1,235,184	$10.961	$2.19
Information	0.20	$670,341	$5.948	$1.19
Professional & Business Services	0.20	$1,771,943	$15.724	$3.14
Education, Healthcare, Social	0.40	$1,274,357	$11.308	$4.52
Arts, Entertainment, Recreation	0.80	$531,116	$4.713	$3.77
Accommodation & Food Service	0.80	$399,877	$3.548	$2.84
Other Services, Except Government	0.20	$343,817	$3.051	$0.61
Government	0.25	$1,963,858	$17.427	$4.36
TOTAL				**$42.83**

Source: FEMA Benefit-Cost Analysis Re-engineering (BCAR) - Development of Standard Economic Values, Version 6.0, December 2011.

[1] Source: original FEMA methodology; Agriculture and Mining data excluded as not relevant for municipal systems

[2] Source: Bureau of Economic Analysis (2010).

[3] Population data from U.S. Census Bureau (2010).

[4] Weighting value of 0.60 averaged the eight sub-sectors with the following values: food/beverage/tobacco products (0.70), paper products (0.60), printing and related support (0.30), chemical products (0.80), textiles/textile product mills (0.70), apparel/leather/allied products (0.50), petroleum/coal products (0.50), and plastic/rubber products (0.50).

[5] Weighting value of 0.70 averaged the nine sub-sectors with the following values: wood & furniture (0.50), nonmetallic mineral products (0.50), primary metal manufacturing (0.90), fabricated metal products (0.80), machinery (0.60), computer/electronic (0.90), equipment/appliances/etc. (0.60), transportation equipment (0.60), and miscellaneous equipment (0.60).

In order to determine the economic impact of water loss on a particular service area, any specific economic sectors that do not apply to the service area can be excluded from the list. The total of all applicable economic sectors for each event provides the per-capita per-day economic loss to industry from the event.

FEMA uses a two-part calculation to determine the welfare loss for residential customers based on the price elasticity of water and the customer's willingness to pay.

The first part of this calculation is based on the FEMA-standard basic water requirement assumption of 6.6 gallons/person/day. In order to calculate the economic impact of loss of this water, FEMA uses a

value of replacement based on an average cost of bottled water, which is $1.89/gallon, resulting in a cost for the first/basic 6.6 gallons of $12.47/person/day.

The second part of this equation is based on the FEMA willingness-to-pay equation. This equation uses the baseline price and demand of water, the basic water requirement demand, and the price elasticity of water to estimate the willingness to pay and consequently the economic loss of the volume of water above basic water requirements. This value was calculated to be $47.53/person/day for the 165.4 (based on a typical total consumption of 172 minus 6.6) gallons beyond the basic water requirement. On a per-gallon basis, this results in a value for the water above the 6.6 gallon basic water requirement of $0.2874/gallon ($47.53/165.4 gallons).

By adding the $12.47/person/day for the first 6.6 gallons and the $47.53/person/day for the remaining average daily water use, FEMA arrives at a total economic impact of $60/person/day.

Industry – Demand Adjustment
The calculation of industry impact from a water loss event is also based on a service area-wide 50% reduction of water use, which results in 50% of the economic reduction than is represented by Table 1. This results in 50% x $42.83 loss/capita/day = $21.42 loss/capita/day.

Residential – Demand Adjustment

The residential impact is similarly based on the assumption that a water loss event would result in a 50% overall demand reduction. The residential impact to a water curtailment event is therefore estimated as 172 gallons*0.5*$0.2874/gallon = $24.71 loss per capita per day.

Therefore, the total water service loss impact taking into account both industry and residential impacts according to the FEMA method would be approximately $6,200,000 /day. Assuming a water outage for 30 days would therefore result in an impact of approximately $186,000,000.

Method 2: AWWA J100 Water Contamination Scenario Consequence Estimation

This method was not evaluated further as discussed in the Methodology section above.

Method 3: U.S. EPA Utility and Service Area-Specific Revenue Loss Financial Analysis

Method 3 of this analysis comes from the U.S. EPA *Water Security Initiative: System Evaluation of the Cincinnati Contamination Warning System Pilot*, August 2011, Appendix B.3, which includes an analysis of water revenue loss based on consumption of area-specific customer classes for commercial, industrial, and institutional entities. The methodology sums the number of entities within each customer class, as identified by the City of Boulder and using the U.S. Census economic data tracking information for each portion of the utility's service area. In addition, an estimated revenue loss for the water service area of a period of 30 days, based on U.S. Census population data, is included in the estimated utility revenue loss.

Water revenue loss was calculated using a unit cost per 1,000 gallons of water (from the City-provided 2015 Annual Report) applied to the total average-day demand during a high-demand month (August) from within the area affected by a water loss event. Duration was factored into the revenue loss estimate using a 30-day scenario.

The following equations were used to determine water revenue loss from data provided by the City for both City departments and by customer class:

- Total Average-Day Demand of Water in the affected area (thousand gallons/day) x $2.53 average water sales charge per thousand gallons = Daily Water Revenue Losses ($/day)

For 2015 Monthly Municipal Consumption (City Departments):

Total water: 220,709 (in thousands of gallons) / month = 7,356 (thousands of gallons /day)

Total Average-Day Demand of Water in the affected area 7,356 (thousand gallons / day) x 2.53 average water sales charge per thousand gallons = $18,610 / day (Daily Water Revenue Losses ($/day))

Daily Water Utility Revenue Losses ($/day) x Duration of Service Outage (days) = Total Water Revenue Loss ($)

$18,610 x 30 days = **$558,000 total water revenue loss ($) for City**

For 2015 Commercial/Industrial/Institutional consumption by customer class:

Total Water: 1,301,645 (in thousands of gallons) / month = 43,388 (thousand gallons / day)

Total Average-Day Demand of Water in the affected area 43,388 (thousand gallons / day) x 2.53 average water sales charge per thousand gallons = $109,772 / day (Daily Water Revenue Losses ($/day))

Daily Water Utility Revenue Losses ($/day) x Duration of Service Outage (days) = Total Water Revenue Loss ($)

$109,772 x 30 days = **$3,293,000 total water revenue loss ($) for Commercial / Industrial / Institutional**

Total water service outage cost under Method 3 = $3,900,000 Total Water Revenue Lost ($) (This amount is based on water sales and does not include the consequences of business/industry earnings.)

Conclusion

CH2M explored three methodologies for developing quick order-of-magnitude estimates of the possible economic impacts to the City of Boulder, CO from a scenario of the complete loss of water service for a 30-day period. Based on these three methods, we suggest that Method 1 provides the most complete and representative estimation for the City's current purposes. This is because it is based on FEMA's industry standard estimation of economic impact of a water service outage for a given population, and takes into account both residential and non-residential impacts.

Method 2 was attempted but found to be not useful for the City's purposes, because it attempted to use a water loss consequence estimation method out of the necessary context of the larger risk-based standard.

Method 3 was found to be useful for developing a representative water revenue loss value, but does not reflect the overall economic loss impact to the region, as does Method 1 based on standard FEMA values and applied in other communities around the US.

CH2M therefore recommends the City consider the results from Method 1 (approximately $6,200,000/day or approximately $186,000,000/30 days) for its immediate conceptual-level purposes, and move forward with a more detailed and stepwise economic analysis as discussed at the outset of this letter if it wishes to refine this order-of-magnitude estimate further.