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

	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

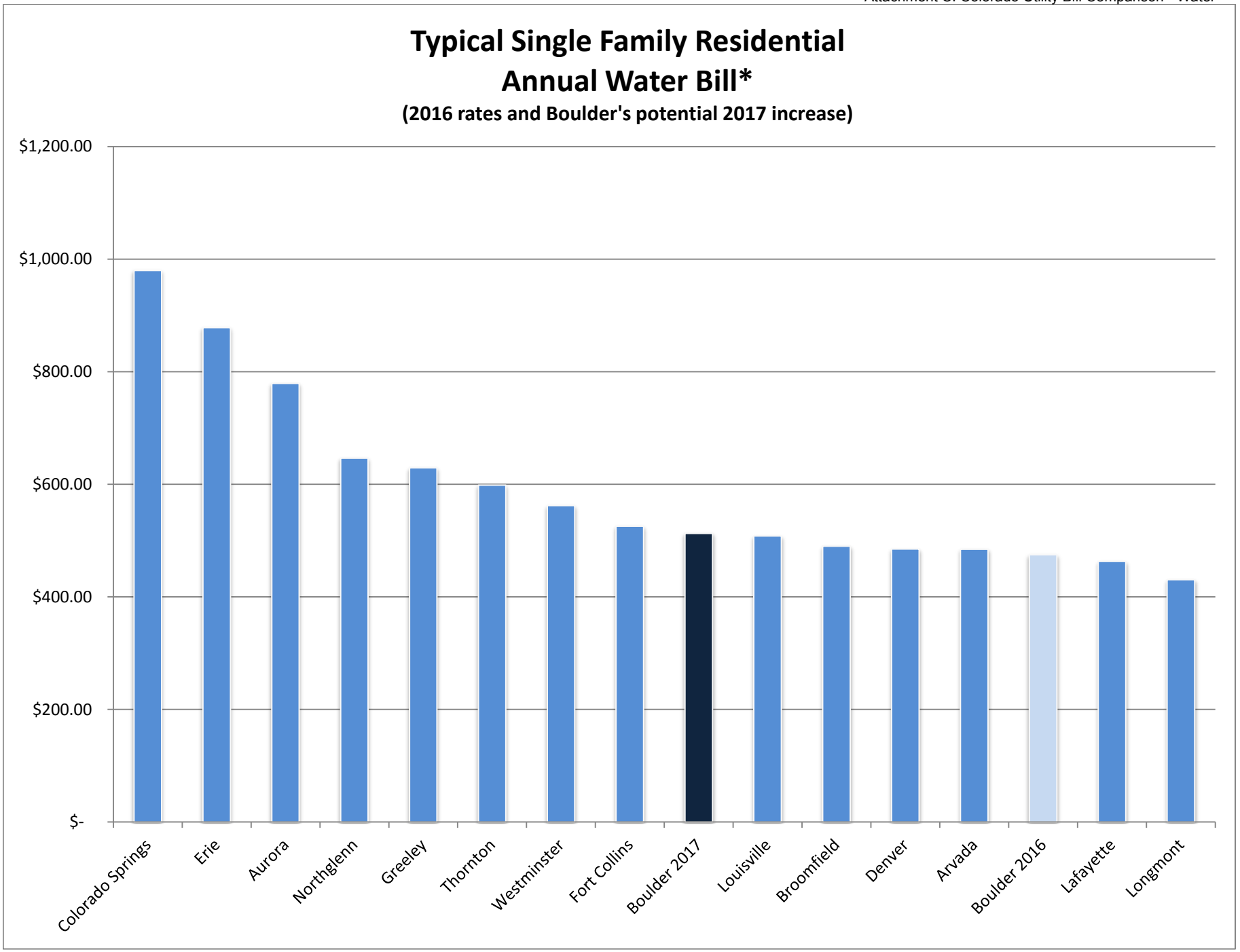
3. As potential capital investments are identified, the city must demonstrate in the CIP process that there are sufficient funds to operate and maintain the project or program.

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

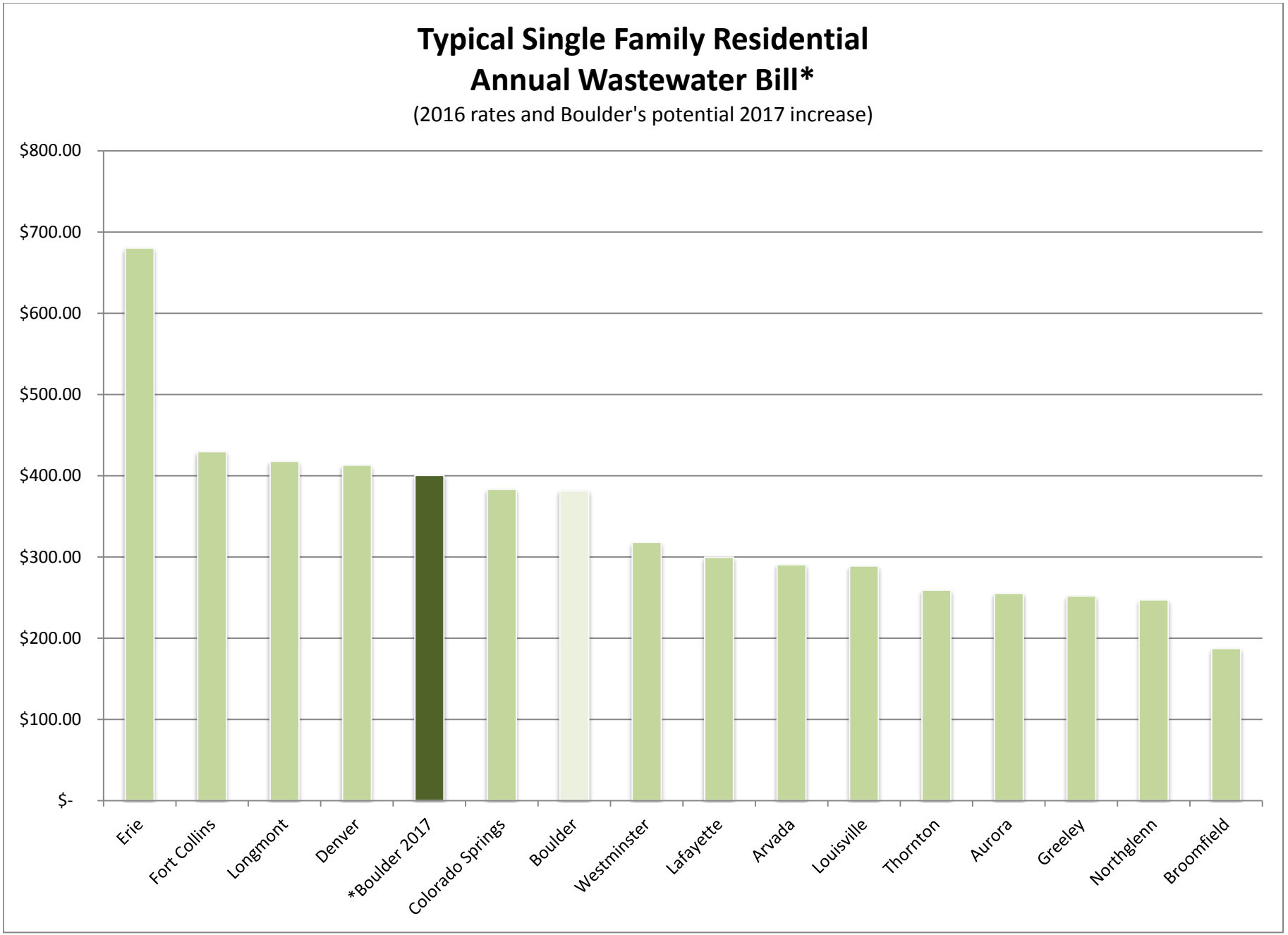
5. Capital Improvement Programs should maintain and enhance the supporting city-wide "business systems", such as information and finance systems, for the city over the long term.

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.



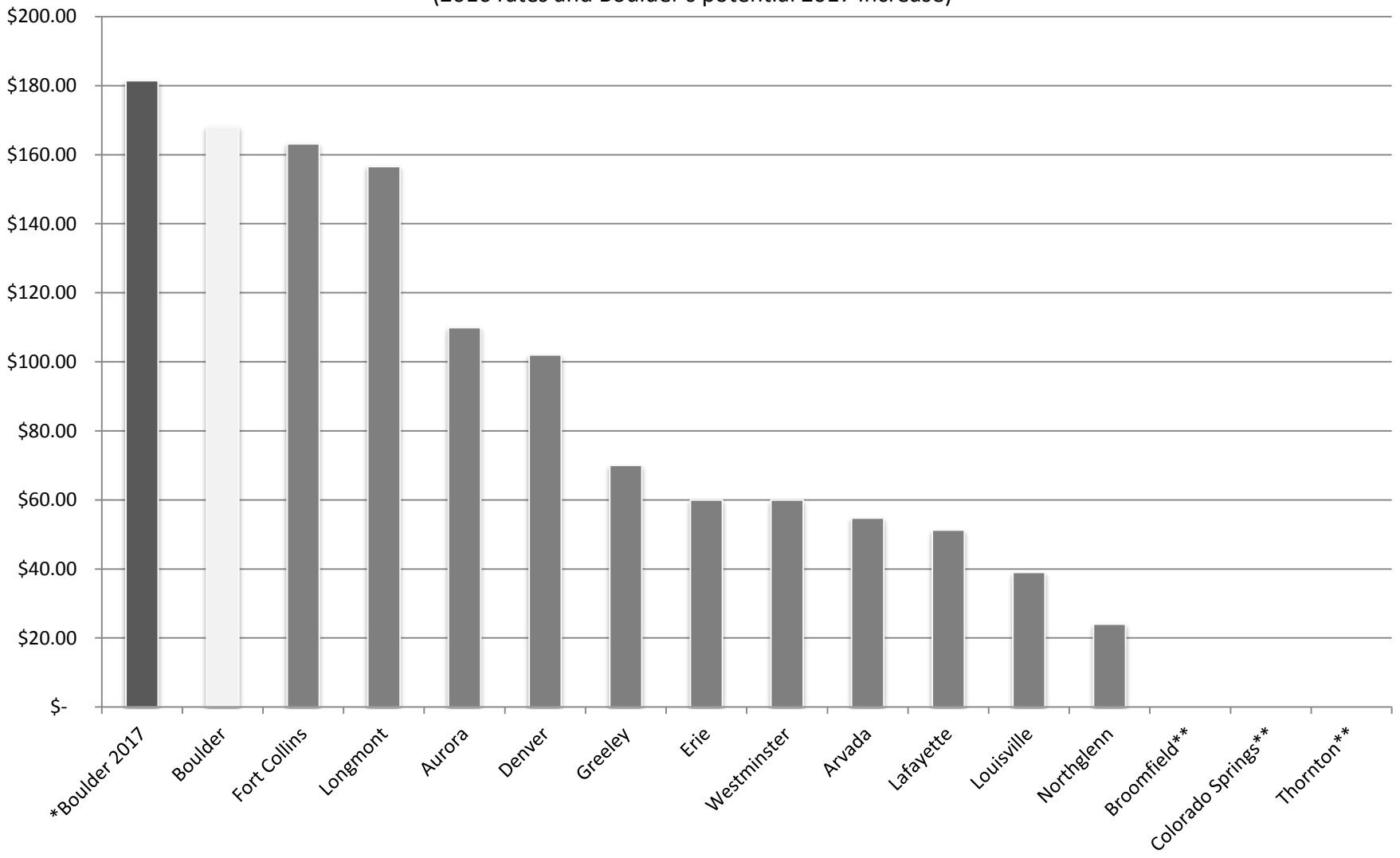
*Assumes 120,000 gal. annual use



*Assumes 5,000 gallons Average Winter Consumption

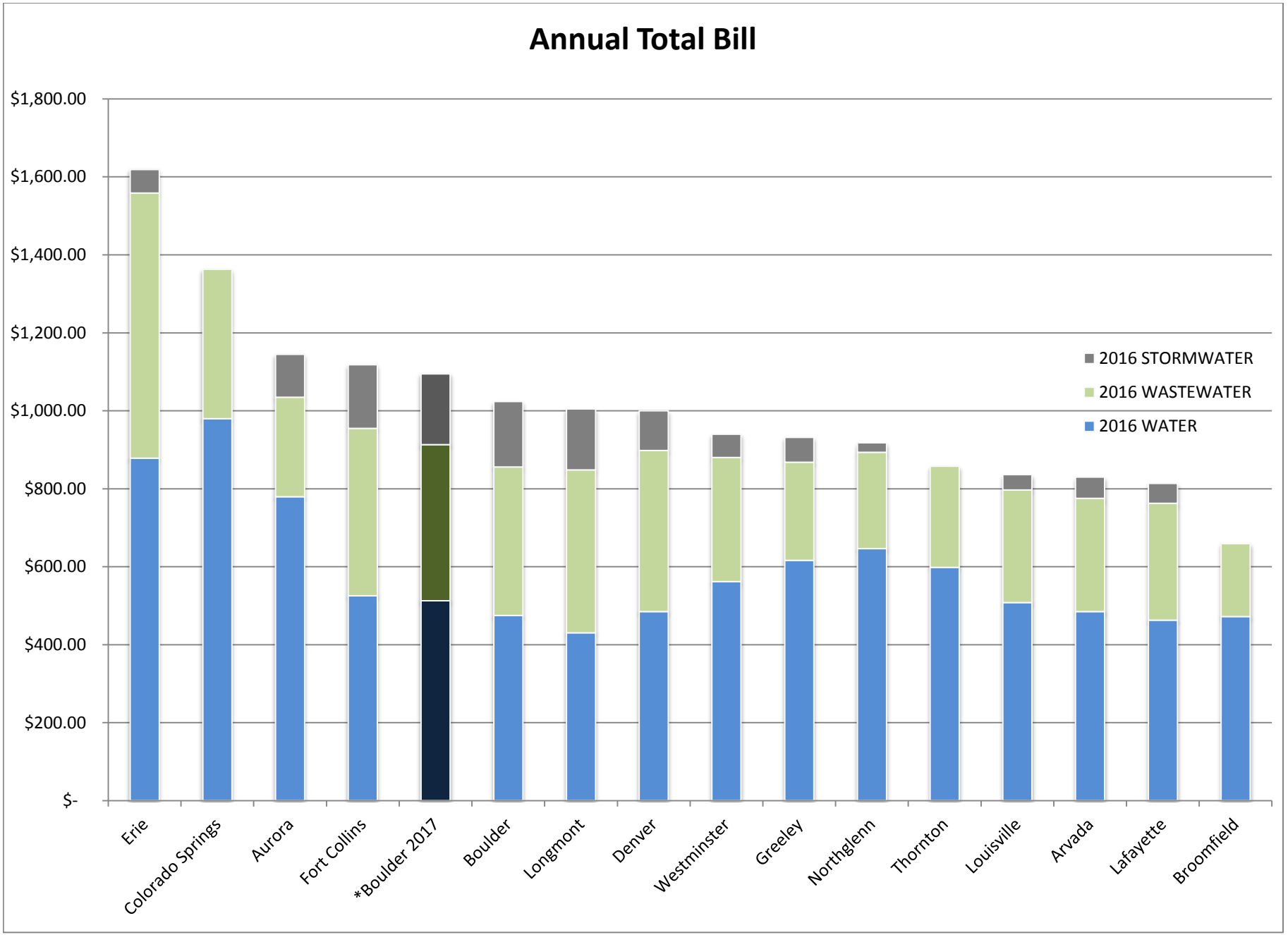
Typical Single Family Residential Annual Stormwater Bill*

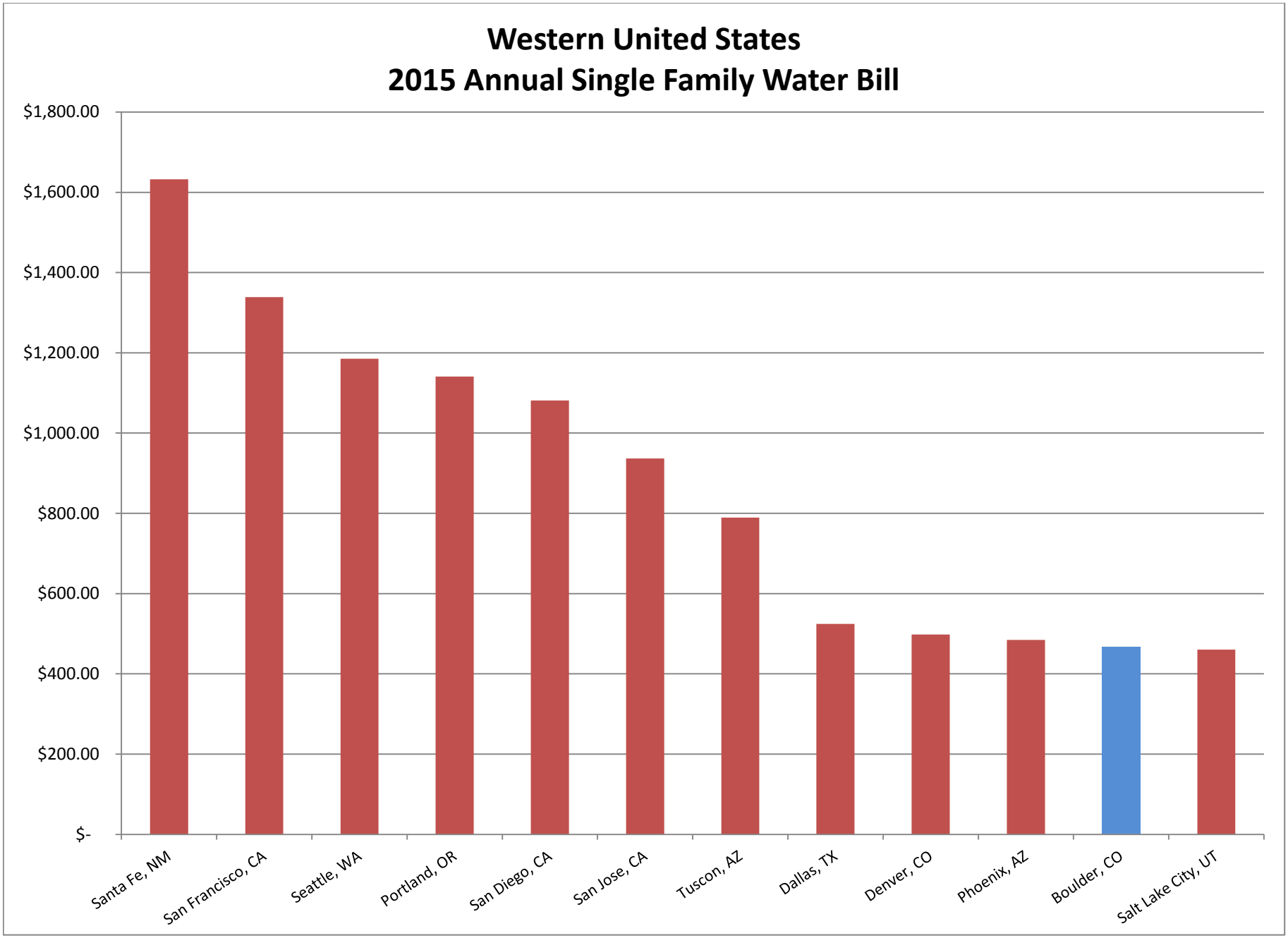
(2016 rates and Boulder's potential 2017 increase)



*Assumes parcel size less than 15,000 sq. ft.

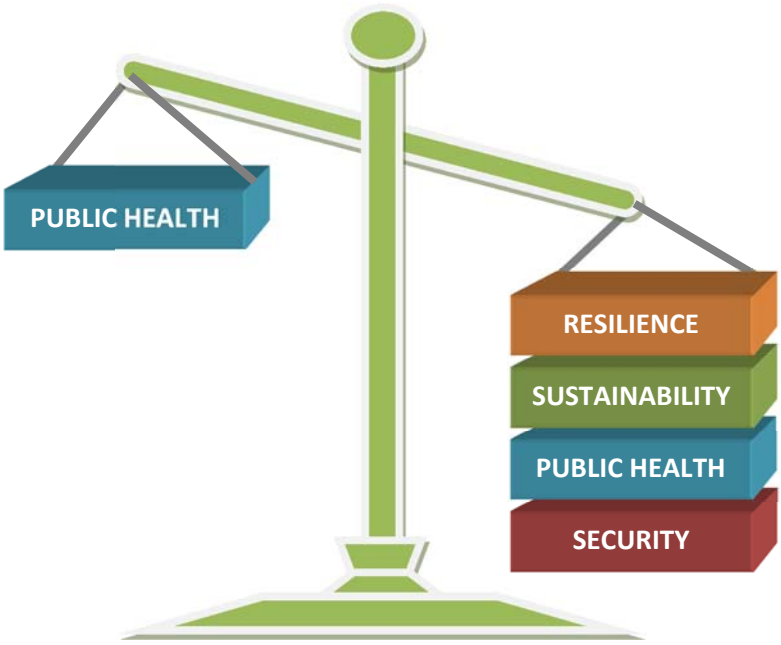
***SW fee is not collected through utility bill.*


Annual Total Bill
$1,800.00
$1,600.00
$1,400.00
$1,200.00
$1,000.00
$800.00
$600.00
$400.00
$200.00
$-
2016 STORMWATER
2016 WASTEWATER
2016 WATER
Erie
Colorado Springs
Aurora
Fort Collins
*Boulder 2017
Boulder
Longmont
Denver
Westminster
Greeley
Northglenn
Thornton
Louisville
Arvada
Lafayette
Broomfield


Western United States
2015 Annual Single Family Water Bill
$1,800.00
$1,600.00
$1,400.00
$1,200.00
$1,000.00
$800.00
$600.00
$400.00
$200.00
$-
Santa Fe, NM
San Francisco, CA
Seattle, WA
Portland, OR
San Diego, CA
San Jose, CA
Tuscon, AZ
Dallas, TX
Denver, CO
Phoenix, AZ
Boulder, CO
Salt Lake City, UT

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:
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.

	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**

[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.