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.

- <u>MCM 5 – Post-Construction Stormwater Management</u>
  - 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.

- <u>MCM 6 – Pollution Prevention and Good Housekeeping</u>
  - 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.

- Other Requirements - Monitoring and Sampling
  - 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.

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.

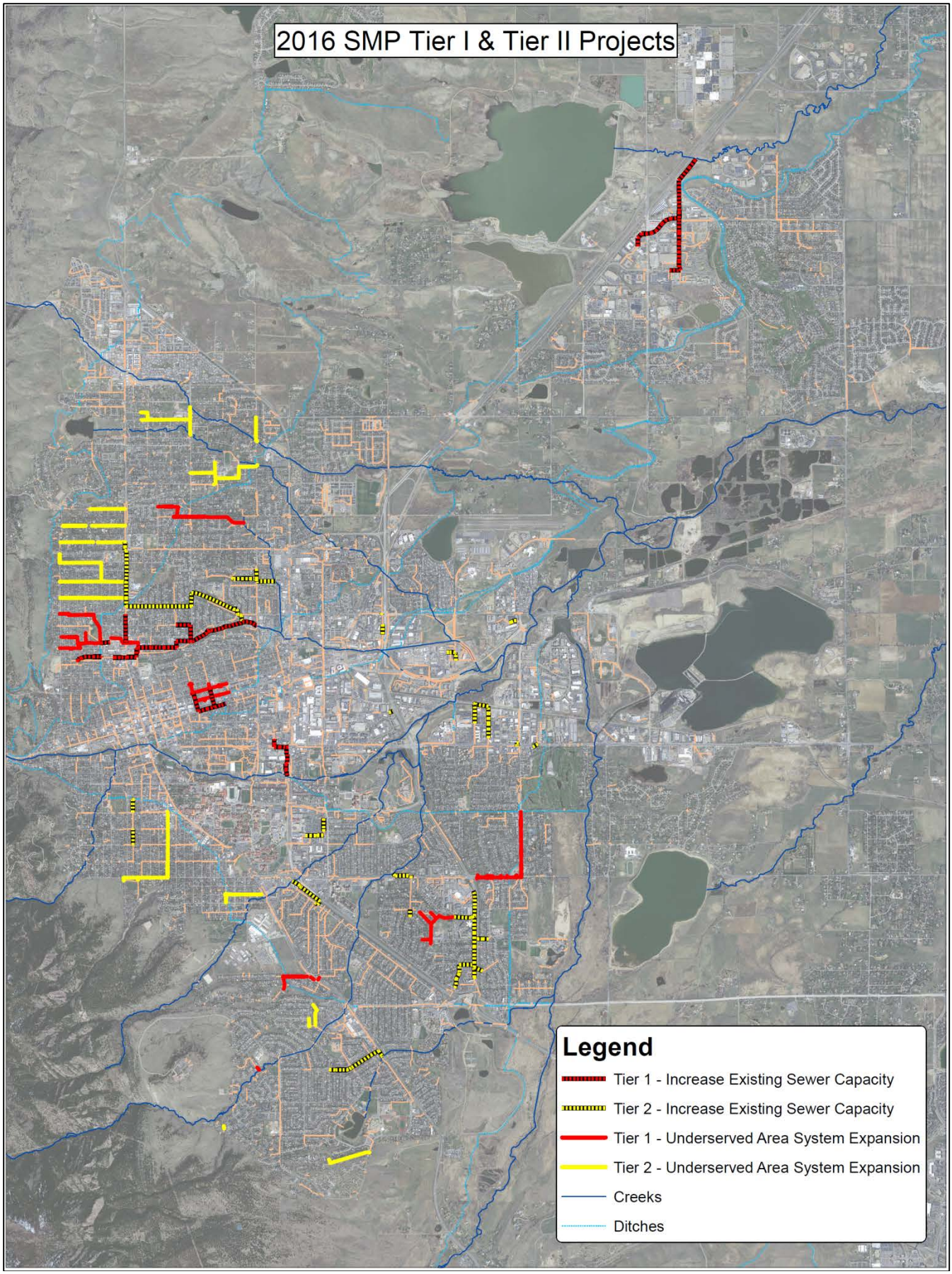

Figure 1 - 2016 SMP Tier I and Tier II Project Recommendations