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
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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.

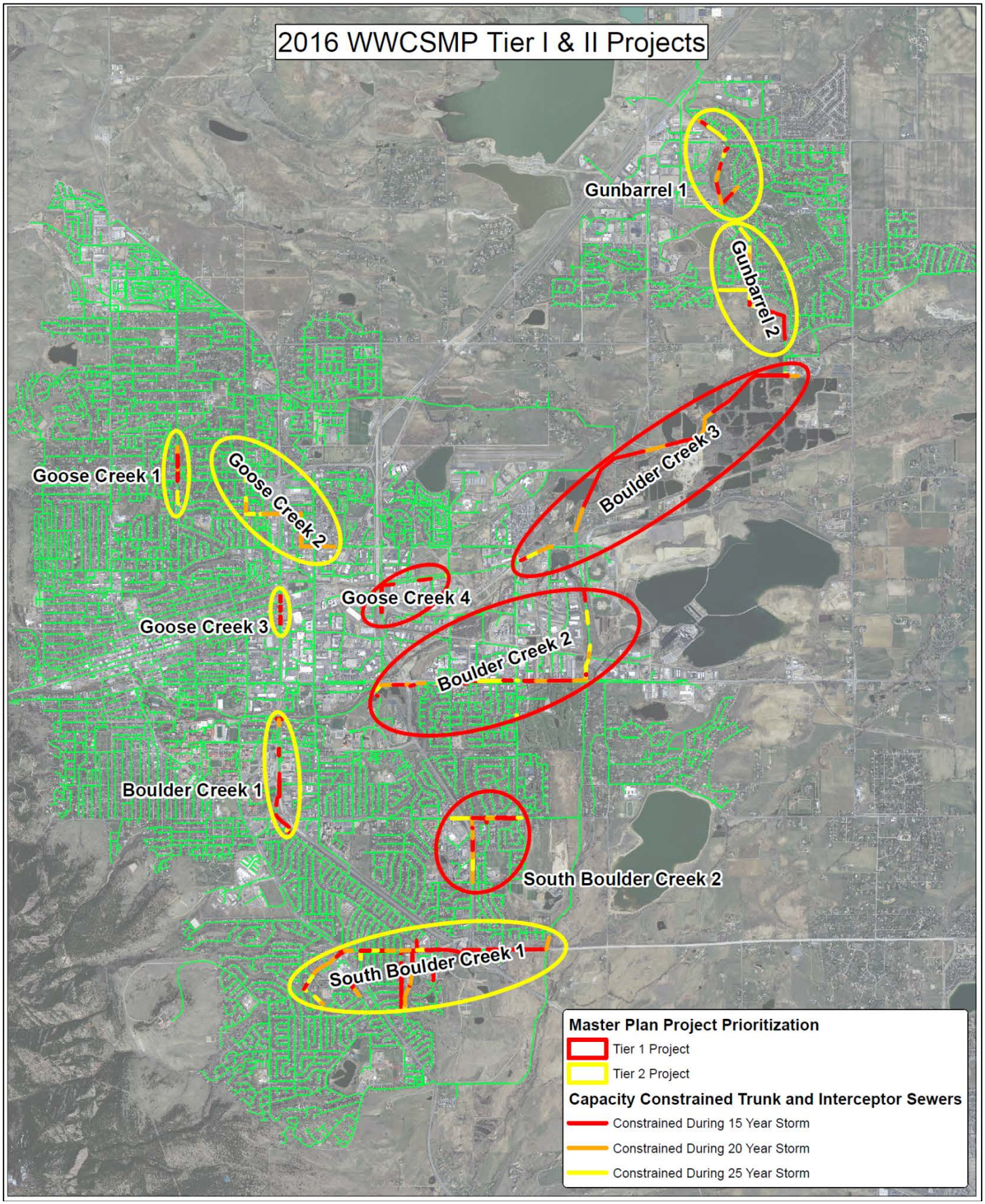

Figure 1 - 2016 WWCSMP Tier 1 and Tier 2 Project Recommendations