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

MEETING DATE: January 27, 2014

AGENDA TITLE: Information Item – 2013 Year in Review

PRESENTER/S:
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I. PURPOSE

A significant portion of the work performed by the Utilities Division relates to the day-to-day operations and maintenance of existing infrastructure. While the WRAB has a very limited role in these activities, recommendations on capital improvements, master plans, and policy issues have a significant impact on operations. This memorandum provides an overview of 2013 operations to provide the WRAB with additional context for upcoming agenda items where the board will be asked to make recommendations.

II. OVERALL MISSION

The mission of the Utilities Division of the Public Works Department is to provide quality water services, as desired by the community, in a manner which protects human and environmental health and emphasizes sound management of fiscal and natural resources. This includes the following services:

- Potable Water Treatment and Distribution
- Water Resources and Hydroelectric Management
- Wastewater Collection and Treatment
- Stormwater Collection and Conveyance
- Water Quality Protection and Enhancement

- Infrastructure Planning, Construction and Maintenance
- Administration and Emergency Planning/Response

III. PRECIPITATON AND TEMPERATURE

Boulder experienced record breaking precipitation in 2013. Total snowfall was 125.6 inches, compared to an average of 90.7 inches. Early to mid-winter was very dry, and March snowpack readings in the North Boulder Creek watershed were significantly below average. Most of the 2013 snowfall occurred during the months of April and May. Boulder's reservoirs filled and spilled, and no drought stage declarations were needed during 2013. At the beginning of the 2013-2014 winter (September – December), the snow water equivalent at the University Camp Snotel site was 5.8 inches which is the historical average.

Total Boulder precipitation for the year was 30.14 inches, compared to an average of 20.69 inches. The previous record for annual total precipitation (29.93 inches) was set in 1995. Although low rainfall for May – September indicated Boulder could experience a year of lower than average precipitation, almost 15 inches of rain were recorded in Boulder between September 9 and 13. This eclipsed the previous record of precipitation from a single storm event of 7.37 inches of rain on May 5-8, 1969. Over half of Boulder's 2013 precipitation fell between September 9 and 16.

The historical rains of September 2013 also had unprecedented effects on the city's source water system. With a peak inflow to Barker reservoir of 408 cubic feet per second (cfs) on September 13, Barker Reservoir refilled and spilled on September 15. This is the first recorded incidence of Barker Reservoir spilling in September and the first recorded incidence of Barker Reservoir spilling more than once per year.

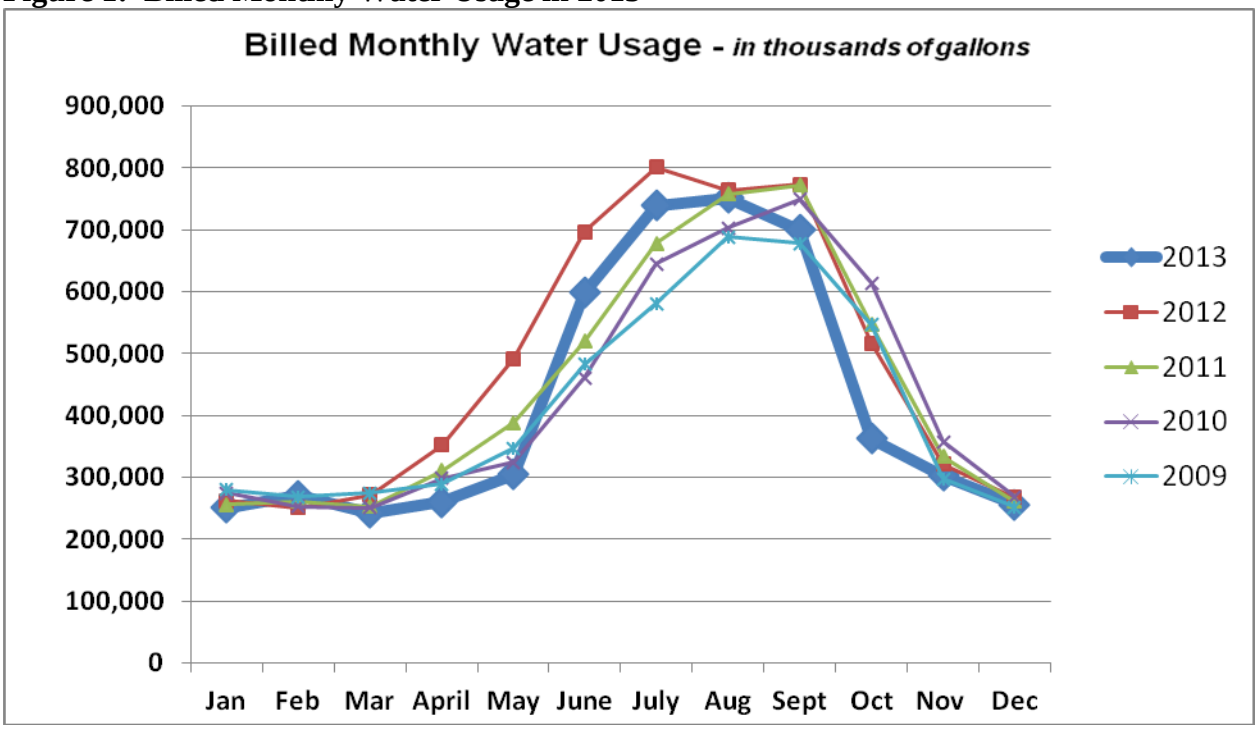
The National Oceanic Atmospheric Administration (NOAA) reported Boulder's mean temperature for 2013 was 50.73 degrees compared to a high of 56.02 in 1954 and a low of 48.91 in 1993.

IV. FINANCIAL OVERVIEW

Water Use Based on Billed Consumption

Billed water consumption in 2013 was the second lowest in over 20 years. Compared to 2012, consumption decreased by over twelve percent. This was due to the unusually hot and dry year in 2012 and record precipitation in 2013. Specifically, precipitation in 2013 was the highest it has been in over 100 years due to the September flood and also a wetter than normal springtime. Because of the flood, it appears that outdoor watering stopped after early September. While it changes from year to year depending on weather, it's estimated that people stopped outdoor watering around one month earlier than usual. As a result, consumption for the month of October was down 35 percent compared to the average of previous years. These trends are demonstrated in Figure 1 comparing yearly consumption by month.

Figure 1: Billed Monthly Water Usage in 2013



Revenues

The lower billed consumption resulted in revenue for water use coming in $1.1M less than anticipated. Fortunately, Plant Investment Fees (PIFs) were at about $1.5M more than projected. This was due to large development projects such as 3100 Pearl and the Peloton. Both the Wastewater and Stormwater/Flood Management Funds were also helped by the higher than expected PIFs, and all the utilities funds ended the year slightly above revenue projections.

Expenses

In December 2013, an adjustment was made to the budget to increase available funds, mostly due to the flood response. These appropriations came from fund balance. A portion of these expenses should eventually be reimbursed by FEMA. The remainder will be covered through rates or re-prioritizing of operating or capital expenses.

V. OPERATION OVERVIEW: WATER RESOURCES

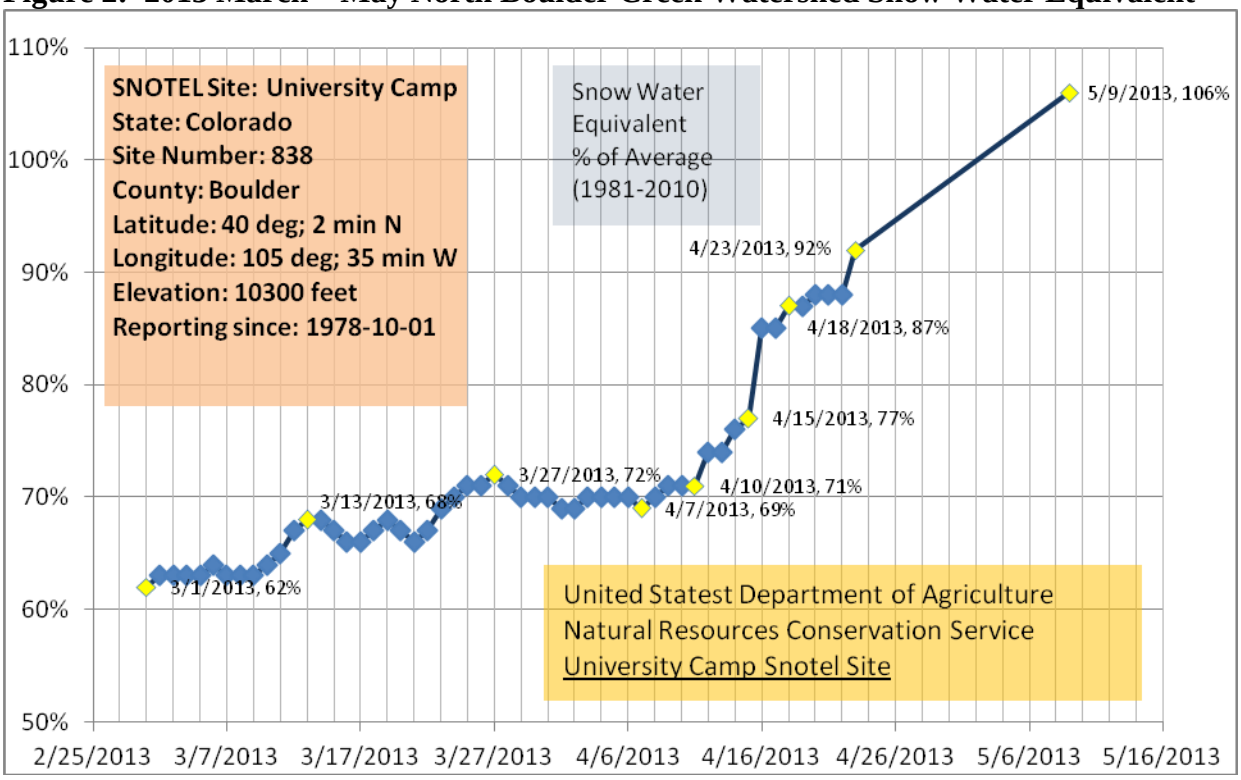
Operations

Snowpack

The city relies upon snowmelt runoff to fill and store water in its upper Boulder Creek basin reservoirs each year. As of March 1, 2013 the snow water equivalent readings (SWE)[1] were almost 40 percent below average. However, heavy late spring snows in April and May improved the SWE to normal conditions as shown in Figure 2.

[1] Snow Water Equivalent (SWE) is the amount of water contained within the snowpack. It can be thought of as the depth of water that would theoretically result if you melted the entire snowpack instantaneously.

Figure 2: 2013 March – May North Boulder Creek Watershed Snow Water Equivalent

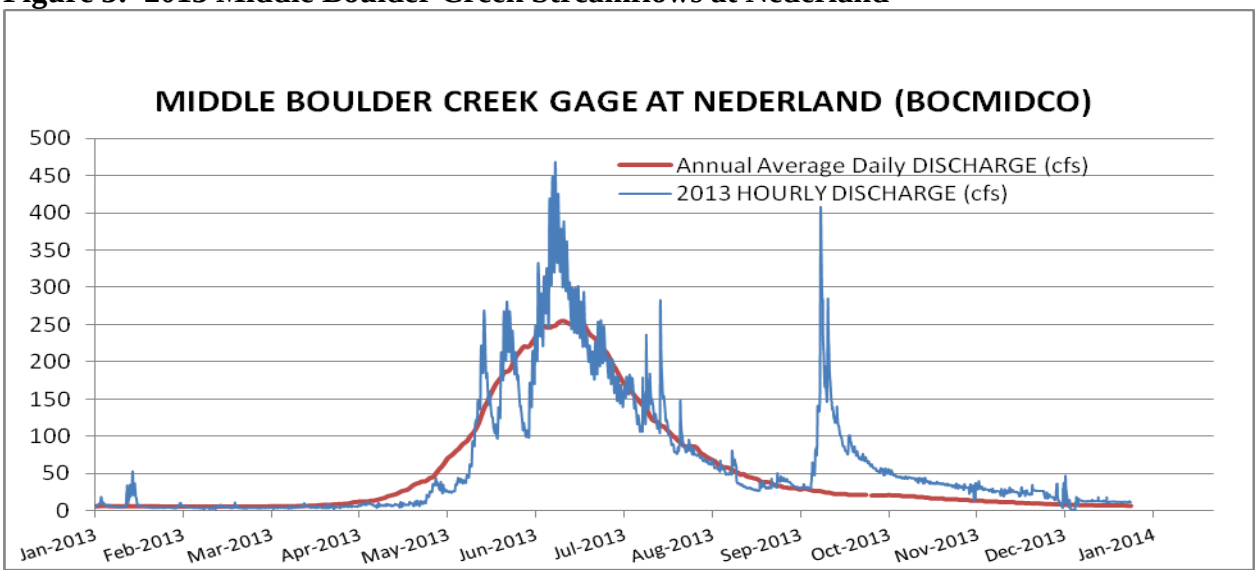


Streamflows

Figure 3 includes 2013 and historical average stream flow conditions upstream of Barker Reservoir. The 2013 peak snowmelt runoff season greatly exceeded the historical average. During the September flood streamflows at Nederland were less than during spring runoff but were still noticeably higher than average. Peak flood flows reached 408 cubic feet per second (cfs) at 2 a.m. on Sept 13.

The September flood also resulted in an unusual water rights administration situation on Boulder Creek. With the exception of a brief period from Nov. 7-Dec 1, a prolonged "free river" condition has existed since the flooding, which means water availability has exceeded active water rights diversions.

Figure 3: 2013 Middle Boulder Creek Streamflows at Nederland



Reservoir Storage Levels and Colorado Big Thompson (CBT) Water Usage

The snowfall and runoff from the 2012-2013 winter allowed the city to fill its mountain storage reservoirs during the spring. After being partially drawn down, Barker Reservoir again filled and spilled during September. This is the only recorded incidence of Barker Reservoir spilling more than once in a single year or spilling in September. Due to the reservoir refill late in the year, the city's total mountain reservoir storage on December 31, 2013 was 16,120 acre-feet, compared to 13,790 acre-feet on December 31, 2012.

The city used a total of 10,307 acre-feet of CBT water in water year 2013 (October 1, 2012 to September 30, 2013).

Figure 4: 2013 Water Supply Conditions in Comparison to 2012

DATE	BOULDER MOUNTAIN RESERVOIR STORAGE (ACRE-FEET)
05/29/2013	**15,673**
05/29/2012	**15,814**
Difference in 2013	-141
	BOULDER MOUNTAIN RESERVOIR STORAGE (ACRE-FEET)
10/25/2013	**17,133**
10/25/2012	**13,160**
Difference in 2013	+3,973
	COLORADO-BIG THOMPSON SYSTEM STORAGE (ACRE-FEET)
05/29/2013	**487,167**
05/29/2012	**646,480**
Difference in 2013	-159,313
	COLORADO-BIG THOMPSON ANNUAL ALLOTMENT (ACRE-FEET)
April 2013	**12,609 (60%)**
April 2012	**21,015 (100%)**
Difference in 2013	- 8,406
	SNOW WATER EQUIVALENT AT UNIVERSITY CAMP SNOTEL SITE
05/29/2013	**11.6**
05/29/2012	**5.4**
Difference in 2013	+6.2

Hydropower, Irrigation Ditches and Agricultural Leasing
The city received $1,944,812 in hydropower revenue for 2013 compared to projected revenue of just over $2 million. Total generation for 2013 was about 42 million kilowatt hours (kWh) or enough to meet the average annual needs of approximately 7,000 households.

Boulder Canyon Hydroelectric (BCH) resumed commercial operation on June 12, 2013 under a new power purchase agreement with Tri-State Generation and Transmission Association. Actual generation and revenue from BCH was about 12 million kilowatt hours and $460,000. The September flood actually increased BCH generation in subsequent months because more water than usual was available for power generation.

During the September 2013 flood, all eight hydroelectric plants were tripped off-line and temporarily ceased generation. The BCH power plant office flooded, but no significant equipment damage occurred at any of the facilities.

The Water Utility is a shareholder in several irrigation ditch companies. Sections of most of the irrigation ditches in and around the city were damaged or compromised as a result of the September flooding. Anderson and Farmers Ditch Companies, which include Utilities staff as board members, are taking the lead in flood related repairs for their respective ditches. The work will be done during the 2013-2014 winter with the goal of being operational for the 2014 irrigation season.

In 2013, the city leased 5,600 acre-feet for agricultural uses and no drought-related curtailment was required in the city's leasing program.

Water Conservation
Although water use restrictions were not required in 2013, regional drought conditions resulted in substantial public concern, particularly prior to the late spring snowfalls. Staff participated in a drought panel presentation to Water Congress, created a new ad campaign, targeted mailing to high water users and designed a "drought meter" for a newly launched Colorado Water Conservation Board drought webpage. The city also continued to collaborate regionally, issuing joint water conservation press releases and placing joint ads. The city was recognized with a 2013 EPA WaterSense Excellence award for a "Drought Busters" program developed with the Center for Resource Conservation (CRC) and subsequently adopted by other cities.

Capital Improvements
In 2013, capital improvements projects in the source water system primarily focused on the Barker facilities, including continued maintenance work on the Barker Gravity Pipeline and performing a pressurized test and inspection of outlet gate number 7 at Barker Dam. At Albion Dam, a temporary solution to unplug one of two clogged outlet pipes was achieved using divers during the late summer. A planned fall inspection of the Albion outlet works had to be delayed until 2014 as the September rainfall prevented the complete draining of the reservoir prior to winter freezing and icing. The Kossler south dam refacing project also had to be delayed until 2014 to allow time for required design revisions. Using updated topographic survey data,

computer modeling of design flood conditions revealed that higher water elevations needed to be accommodated in the Kossler design.

Upcoming Key Issues

Completion of the Albion Dam outlet works inspection and the Kossler south dam refacing projects that were delayed in 2013 are now planned for completion in 2014. Another key focus for 2014 will be revisiting impacts of climate change on water supply including an update to the Water Conservation Futures Study.

In the city's hydroelectric program, five of the city's existing power purchase agreements (PPAs) will expire between 2015 and 2017. The city has the option to extend these agreements, most of which are for a 30-year term. Staff will research potential hydropower sale options, including city use of the power under a municipilization scenario, to make sure the city obtains the most favorable PPA terms in the future. Evaluation of specific PPA options will begin in 2014.

VI. OPERATION OVERVIEW: WATER TREATMENT & DISTRIBUTION

Operations

Due to the record breaking precipitation, the total water production during 2013 was 5,733 million gallons (MG), which is the second lowest total water production in the last 10 years. The Betasso Water Treatment Facility (Bessato), which has a capacity of 40 million gallons per day (MGD) and treats water from the Boulder Creek watershed, treated 75 percent of the total water use in the city. The Boulder Reservoir Water Treatment Facility (BRWTF), which has a capacity of 16 MGD and treats water from the Colorado Big Thompson (CBT) water system, treated 25 percent of the total water used in the city.

BRWTF operations were significantly impacted by the September flooding. The facility experienced a power outage early in the storm event and ultimately remained offline until October 1 due to turbidity issues in Boulder Reservoir and damage to the Boulder Feeder Canal from Carter Lake. Following a 10-day testing period to ensure operability, the facility was shut down due to low demand. The facility is expected to resume operation in early 2014.

Betasso suffered minimal damage due to the 2013 flood, although it operated on the emergency generator for approximately three days before power was restored. Power and communications to the SCADA system were lost at seven critical reservoirs and flow control stations for weeks, however no water quality or quantity disruptions or violations occurred due to the flood (or in the whole of 2013). Obtaining chemical deliveries and emergency generator fuel posed great challenges, and many deliveries and plant personnel were re-routed through Nederland via 1-70 and down Sugarloaf Rd (which is hazardous for 18 wheelers) until CO Highway 119 was re-opened.

In 2013, the drinking water system met all regulatory compliance requirements. Staff distributed the required Consumer Confidence Report electronically for the first time and conducted regulatory monitoring for 30 unregulated contaminants (UCMR3) to provide occurrence data and basis for future regulations. Staff initiated a collaborative pre- and post-fire watershed planning project that includes a systematic analysis for forest/watershed protection. Boulder Reservoir

water quality thresholds were developed to integrate with Parks and Recreation Site Management Plan. Staff implemented the IWLive model for real-time water distribution system modeling capabilities and made improvements to remote monitoring at storage tanks and pump stations.

Maintenance activities in the distribution system were increased this year by adding a contractor to assist with fire hydrant maintenance and valve operations. During the post-flood period, a contractor was able to perform inspection and maintenance services to 931 fire hydrants and 1,441 fire hydrant and mainline valves. Increased construction activity in 2013 had a significant impact on the demand for utility locates with approximately 12,000 requests.

Capital Improvements

During 2013, several improvements and studies were done at the BRWTF. One was implementing improvements and modifications to the carbon dioxide system to provide more consistent acid feed capabilities. Another was performing an Arc Flash Hazard Analysis and Relay Coordination assessment of the electrical system. A study and final design of a flash mix pumping system for the combined filter effluent was completed and submitted to the Colorado Department of Public Health and Environment (CDPHE) for review and approval. Receiving approval in late 2013, bidding and installation of this system will take place in 2014.

At Betasso, the consulting firm Brown and Caldwell (BC) was selected to perform a study to identify options to alleviate the residuals issues. The first phase of work performed included reviewing existing reports and process data in order to fully characterize current residuals production. General descriptions of each alternative were presented together with sizing and cost information by various equipment manufacturers. On-site pilot trials will be conducted in 2014 following study recommendations.

In 2012, the city contracted with Malcolm Pirnie, the Water Division of ARCADIS (ARCADIS) to assist in the investigation of methods to improve the Betasso filter productivity during high color events. In 2013, the priority was to set up a pilot for these trials. In 2014, the goal is to utilize the pilot for identification of future filter improvements, assessment of ferric chloride for arsenic removal, and spring runoff optimization.

Upcoming Key Issues

Water quality conditions at Boulder Reservoir after the flood have significantly diminished, requiring additional attention to the quality of water delivered to the BRWTF. When the facility resumes operations, a weekly taste and odor test will be conducted. Information will then be used to answer questions from the public or make changes to the treatment processes.

For the near-term, the upcoming issues related to Betasso include finalizing the residuals study (Brown and Caldwell), the filter performance study (ARCADIS), and continuing to identify and prioritize plant needs for the 2016 capital project.

Related to water quality, CDPHE is initiating a stakeholder process to update the Colorado Primary Drinking Water Regulations and city staff will be part of the process. City staff will also work on implementing an online form for backflow prevention reporting directly by customers

and testers, and further implementing utility standard operating procedure document management in Laserfiche.

VII. OPERATION OVERVIEW: WASTEWATER TREATMENT & COLLECTIONS

Operations

The Wastewater Treatment Facility (WWTF) operated with no effluent permit violations in 2013, treating an average of 15 MGD of wastewater. Due to the extreme precipitation and associated flooding in September, the WWTF flows were unprecedented and significantly increased the overall annual average. Staff successfully transitioned away from gaseous chlorine and sulfur dioxide for disinfection as the new UV disinfection system was commissioned. Throughout the year, the UV system has been optimized and a dose of 1/3 to 1/2 of the original value has been accomplished, which should yield ongoing operations and maintenance savings. A $1,080,000 grant from the State of Colorado was received to help fund planning, optimization, design, and construction of nutrient removal improvements, specifically nitrogen. The third full year of using electric power generated from Solar PV occurred during 2013 at the WWTF, with the overall system production to date exceeding 5 million kWh. When combining solar power with power generated by the cogeneration system, approximately 1/3 of the electrical power needs for the WWTF were generated by renewable technology in 2013.

The September flood had a significant impact on the wastewater collection system including surcharges and deposition of sand, rock, and debris throughout the nearly 400-miles of collection system piping. Utilities engineering and maintenance staff continue to work closely with contractors to assess and inspect (TV) the collection system to determine maintenance and cleaning priorities to prevent blockages and backup events. In late 2013, staff began using localized Cast in Place Pipe (CIPP) repairs to address isolated breaks and holes in city mains. Each repair can be done at a third of traditional costs, in half the amount of time. In addition, staff has also started to use an injectable grout in manholes to reduce infiltration and inflow. Staff has completed the Pipe Assessment and Certification Program (PACP) and will be re-evaluating problematic root and grease lines for the purpose of prioritizing cleaning efforts. This should help optimize the frequency of cleaning and minimizing future backups.

Regulatory efforts focused on Boulder Creek data collection to address future nutrient regulatory requirements, refinement of restrictive ammonia effluent limits and compliance with Boulder Creek aquatic life criteria. Staff actively participated in multiple State-directed work groups focusing on implementation of future nutrient regulations, implementation and modification of arsenic water quality standards, implementation of the impaired waters listing for the next 303(d) list and revised sediment criteria. Efforts continued to regulate industrial discharges through the Industrial Pretreatment Program through the renewal of permits for major dischargers such as the University of Colorado. The WWTF and BRWTF laboratories continued to expand in-house analytical capabilities and completed over 50,000 analyses in 2013.

Capital Improvements

The $8M upgrade project to modernize the headworks and digester facilities, and install the UV disinfection system, was completed in 2013. This project was a significant step forward in addressing a major safety risk (the use of chlorine gas and sulfur dioxide gas), and replacing

aging mechanical and electrical infrastructure. Additionally, a Strategic Plan for the Process Automation System (PAS) at the WWTF was completed to serve as a roadmap and implementation tool to upgrade the hardware and software components to the instrumentation and control systems.

Within the wastewater collection system, approximately 19,700 feet of 8", 12", 21", and 24" mains were lined by a contractor at a cost of $547,000. City crews were able to rehabilitate 281 manholes. Additionally, the manholes in Arapahoe Avenue from 14th Street to Folsom Street were rebuilt in conjunction with the transportation project in that corridor.

Upcoming Key Issues

With adequate hydraulic and process capacity, the focus moving forward for the WWTF will be regulatory issues and aging infrastructure. Regulatory drivers in 2014 include nitrogen (daily maximum ammonia and nitrate, as well as Regulation 85 total inorganic nitrogen), and an associated design project will identify treatment modifications to meet these limits. Two other key capital issues are upgrades at the IBM Lift Station to address several concerns including emergency flow storage, as well as a determination of the path forward for the aging cogeneration system. The status of city-wide electric utility municipalization may factor into decisions about cogeneration. Key operational issues for 2014 will involve organizational changes and associated technology to support unattended operation at night as a departure from 24/7 coverage.

The city is moving forward with the development and implementation of a more aggressive, proactive wastewater collection system operations, maintenance, and renewal plan. Part of this approach will include using significant contractor resources to perform sewer cleaning and inspection as part of a new condition assessment program. Typically, such a condition assessment is scheduled with a five-year recurrence interval; however, due to the September 2013 flood the initial condition assessment cycle will need to be expedited to two years in order to assess flood damage.

Additional water quality studies will be conducted in 2014 focusing on sources of arsenic, fate and transport of nutrients in Boulder Creek and evaluation of ammonia toxicity in Boulder Creek. These efforts are necessary to support future compliance requirements of the WWTF integrated into state-directed regulatory work groups.

VIII. OPERATION OVERVIEW: STORMWATER & FLOOD MANAGEMENT

Operations

The city's stormwater and flood management utility prepares the city for significant rainfall events through floodplain mapping, risk assessments, floodplain regulations, public education, flood insurance, flood preparedness, master planning, stormwater quality programs, and maintenance. Operations were significantly impacted and reprioritized to respond to the September flood.

Flood control maintenance operations include vegetation control in and around waterways, mowing of native grass channels and embankments, as well as cleaning and inspection of trash

racks for ditch company agreements and culverts under roadways. This work includes both planned and responses to calls from the community. The 2013 year was a busy season due to the late and wet spring conditions which made for a shortened window of maintenance before water began flowing in creeks and ditches. The wet weather also increased the mowing cycle frequency and added to the growth of vegetation. Due to the September flood, the number of calls for service from the community significantly increased. Staff responded by removing sediment and debris from trash racks, culvert, channels, paths, bridges and other structures throughout the system. In 2013, the city implemented a new Constituent Relationship Management (CRM) tool called Inquire Boulder to track service requests which will enable the city to improve data comparison from year to year.

City Council approved a "Critical Facilities" ordinance requiring certain land uses to meet higher regulatory standards for development in floodplains. This ordinance was the result of a multi-year process that removed numerous requirements contained in initial drafts to address concerns from potentially regulated businesses.

The state-issued Municipal Separate Storm Sewer System (MS4) stormwater permit was substantially revised in a draft released by the state in late 2013. Substantial effort was spent on providing comment and revisions to the draft revised permit. A new MS4 permit is expected in mid-2014 and will likely include additional regulatory requirements for stormwater discharges.

The development of a more robust drainageway asset management system integrated with the existing maintenance management system, along with updated condition assessments was fortuitously completed prior to the September 2013 flood disaster. This documentation should prove valuable in applying for damage reimbursement from FEMA as well as the planned on-going use of this information from planning purposes.

Capital Improvements

Floodplain mapping studies to identify hazards and support mitigation efforts generally involve a multi-year study and process prior to submittal to FEMA for review and adoption. For instance:

- New topographic base mapping using LiDAR technology was recently completed and will be used in future mapping projects.
- Twomile Creek/Upper Goose is currently being remapped.
- A mapping study of Boulder Creek is currently in review by FEMA.
- Mitigation planning for South Boulder Creek is ongoing.
- The Goose Creek Restoration Project was implemented to improve wildlife habitat and water quality along Goose Creek between 47th St. and Boulder Creek.
- A mitigation project on Wonderland Creek, upstream of the Kings Ridge neighborhood, had been designed and slated for construction prior to the flood.

In 2013 the city installed approximately 3,500 feet of new stormwater collection and conveyance sewers under Arapahoe Avenue from 14th Street to Folsom Street and approximately 1,000 feet of storm sewers along Pearl Street as part of the Boulder Junction Project.

Upcoming Key Issues

The September 2013 flood will continue to influence both operations and capital efforts for 2014. Significant sediment and debris removal will be required to restore capacity of both local and major drainage systems. Longer term efforts will be required to restore habitat and features such as drop structures and sediment traps. Additional key issues will include prioritization and funding of mitigation projects, consideration of property acquisition to reduce hazards and/or allow mitigation, and consideration of changes to regulations and design standards to provide a higher level of protection from future floods.

A new MS4 stormwater permit will be issued in 2014 and staff will continue to actively participate in the state-directed permit development process. Additional regulatory requirements, including reporting, water quality monitoring and stricter enforcement will likely be part of the new permit. As a result, changes will need to be made to the Boulder Revised Code, city ordinances and city Design and Construction standards in order to comply with new permit requirements.