

**CITY OF BOULDER  
WATER RESOURCES ADVISORY BOARD  
INFORMATION ITEM**

**MEETING DATE: December 14, 2015**

<p><b>AGENDA TITLE:</b> Update on Wastewater Treatment Facility Permit Renewal and Regulatory Activities</p>
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<p><b>PRESENTER/S:</b></p>
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**EXECUTIVE SUMMARY:**

The purpose of this memorandum is to update WRAB on the status of key permit compliance items associated with the treated effluent from the 75th Street Wastewater Treatment Facility (WWTF). The Colorado Discharge Permit System (CDPS) permit renewal is the first high priority item, and important regulatory issues are also covered herein.

The outcome of the WWTF permit renewal has significant and direct impacts on how the WWTF is operated, maintained, and sets necessary funding schedules associated with the Capital Improvements Projects (CIP) program, which in turn affects the Wastewater Utility Fund and rates of wastewater services within the community.

City staff remain proactive with respect to upcoming regulatory concerns that could impact the city's wastewater treatment program. Some of the regulatory issues are aspects of the current permit and have evolved over time (i.e. copper, arsenic, temperature). Examples of new issues that are expected to be implemented in the WWTF permit renewal are nitrate and nutrients. Current status of each regulatory item is summarized along with known options to achieve and maintain regulatory compliance.

**BACKGROUND:**

The city's 75<sup>th</sup> WWTF CDPS permit was last renewed in 2011(May 1 effective date) and expires April 30, 2016. Permit limits of most concern in the current CDPS permit are the future low daily maximum ammonia limits, daily maximum nitrate limits, and a low monthly average arsenic limit. A monitoring only requirement for temperature was also included in the permit

and could lead to a temperature effluent limit in the future. A copper Temporary Modification is effective until December 31, 2015 to address potential non-compliance with copper effluent limits and allowed time to develop a site-specific approach for compliance. The current CDPS permit also includes a compliance schedule for ammonia, nitrate, arsenic, temperature, and copper, and multiple annual progress reports are also required.

Since the current CDPS permit effective date, additional regulatory requirements have been adopted by the Colorado Water Quality Control Commission (Commission). New regulations with significant future WWTF impacts include Regulation 85 – *Nutrients Management Control Regulation*, technology-based total inorganic nitrogen (TIN) and total phosphorus (TP) effluent limits. Regulation 31 – *Basic Standards for Surface Water*, Interim Nutrient Values were also adopted and when effective will require very low total nitrogen (TN) and TP effluent limits.

City staff continued to work with the Colorado Water Quality Control Division (Division) regulatory and technical work groups to address the basis for new and future regulatory requirements. Staff have also been active in Commission Rulemaking Hearings requesting additional time to collect needed data and to develop site-specific approaches to protecting Boulder Creek beneficial uses and developing protective water quality standards.

WRAB last received an update on CDPS permit renewal efforts and regulatory issues related to the 75<sup>th</sup> Street WWTF permit in October 2012 (*reference Agenda Item VI from the October 15, 2012 WRAB Meeting*). Many of the same issues remain, and this memorandum will update WRAB with the most recent information.

## **ANALYSIS:**

### **75<sup>th</sup> Street Wastewater Treatment Facility CDPS Permit Renewal**

The city's 75<sup>th</sup> WWTF CDPS permit (No. CO-0024147) was last renewed in 2011. Consistent with the 5-year renewal timeline, the current permit is set to expire April 30, 2016. As renewal applications are due 6-months prior to expiration, city staff collaborated with a consultant to complete the significant renewal packet. The renewal application submittal was delivered to the Division on October 28, 2015.

**Schedule.** The current permit was administratively extended three and a half years beyond the original expiration date, largely due to Division workload. Recent discussions with the Division about renewal timing suggest that 75<sup>th</sup> Street WWTF CDPS permit will likely receive a brief administrative extension (less than 6 months duration) and renewal is anticipated near the end of 2016.

**Highlights and Requests.** As part of the 75<sup>th</sup> Street WWTF CDPS permit renewal application, the city highlighted certain items for the Division to focus on during evaluation of the CDPS permit renewal:

- Request for two WWTF flow-based tiered effluent limits

- Request for monthly ammonia and nitrate limits
- Request for tiered ammonia and nitrate limits
- Ammonia water quality modeling using the AMMTOX model
- Biochemical Oxygen Demand (BOD) concentrations as analyzed by total organic carbon (TOC)
- Effluent flow reported with facility-specific calculation

Brief details on each of these evaluations and requests are provided below, and will be discussed further as desired at the WRAB meeting.

**Two Flow Tiers.** The current permit includes limits established within two WWTF flow tiers (less than 20 MGD and between 20 and 25 MGD). Establishing a lower flow tier provides some relief for mass balance based effluent limits, as loading theoretically remains the same with lower flow and higher concentrations. To better align with historical and expected WWTF flows, a low flow tier of 18 MGD and less has been requested (high flow tier would be between 18 and 25 MGD).

**Ammonia and Nitrate Limits.** Due to the importance of compliance with ammonia and nitrate limitations, and the costs associated, the city requested both monthly limitations as well as tiered limits. Monthly limitations involve concentrations that are adjusted monthly to better represent seasonal changes and receiving water quality conditions, and result in some months with less stringent limitations and others where limits are low. Tiered limitations provide some appropriate additional compliance cushion, as most months will result in an effluent flow of less than 18 MGD.

**Ammonia Modeling with AMMTOX.** The current permit contains daily maximum ammonia limits derived using the former Colorado Ammonia Model that are presently being met comfortably, however, ultra-low ammonia limits are set to go into effect on December 1, 2017 that were established using the newer AMMTOX model. The city has previously partnered with other wastewater dischargers in the Boulder, St. Vrain, and Coal Creek basins to collaborate and share costs of having Dr. Bill Lewis (CU-Boulder) perform the ammonia modeling effort and develop scientifically-valid ammonia limits. Earlier this year, the so-called tri basin group modeling effort was conducted once again, using the most recent WWTF effluent and receiving water data. Final results from the modeling show some relief in concentrations of ammonia for 8 of 12 months (4 months are slightly more stringent). The modeling report and developed limits are part of the permit renewal submittal to the Division.

**Total Organic Carbon for BOD.** City staff performed excellent background research into the feasibility of embracing TOC analysis as a substitute to the traditional BOD test. TOC is regularly used in drinking water analysis and other water quality work, traditionally with water matrices that are cleaner than wastewater. Advances in the analytical capabilities have allowed accurate and efficient analysis of TOC in wastewater samples, and reliable correlations of TOC vs. BOD have been developed. Some utilities in California, and others in Canada, have successfully implemented TOC as a substitute for BOD by working with their regulatory agencies. If successful, Boulder would be the first in Colorado to do so.

**Effluent Flow Reporting.** Historically, the 75<sup>th</sup> Street WWTF has not had an effluent flow meter so effluent flow is assumed to be equivalent to influent flow. In 2013, new flow meters at the UV system and associated non-potable water pump station now allow for an accurate reporting of effluent flow, via calculation.

**Other Items.** It is expected that a new parameter, nonylphenol, will be added to the permit as a monitoring (report-only) provision. Nonylphenols are generally man-made chemicals that are commonly used in manufacturing processes for various products (antioxidants, lube oils, detergents) and are concerning due to their ability to behave as endocrine disrupting compounds (EDCs). Nonylphenols can be difficult to biodegrade, however, proactive research has shown that percent removals from the 75<sup>th</sup> St. WWTF are quite high. Thus, compliance with a future numeric limit for nonylphenol is not anticipated to be a problem.

## **Regulatory Update**

City staff are actively involved in evaluating existing and future regulatory requirements through Division regulatory and technical work groups and Commission Rulemaking Hearings. Provided below is a summary of regulatory changes that could impact wastewater treatment requirements and activities performed by city staff.

**Nitrate.** The Division is proposing to modify the point of compliance (in Boulder Creek) for the nitrate drinking water standard of 10 milligrams per liter (mg/L). Currently, the nitrate standard is applied at the point of raw water diversion to a water treatment facility. For Boulder Creek the closest point of diversion is the Lower Boulder Ditch diversion at 95<sup>th</sup> Street (emergency diversion for the City of Lafayette), approximately 2.8 miles downstream of the 75<sup>th</sup> Street WWTF.

The Division is proposing to move the nitrate point of compliance to the end of the regulatory mixing zone, which is approximately 0.1 miles downstream of the 75<sup>th</sup> Street WWTF, as part of the Basic Standards Rulemaking Hearing process in June 2016. This change will limit the ability to account for nitrate loss in Boulder Creek and will reduce the nitrate WWTF effluent limit to approximately 10 mg/L from the currently proposed 14.7 mg/L limit. Staff are working on a proposal to the Commission for a delayed effective date of 2021 (instead of September 2016) for the change in nitrate point of compliance. The delay will allow the city and other dischargers to develop an approach to support keeping the current nitrate point of compliance or some other alternative.

**Arsenic.** In 2007 the Commission adopted a restrictive arsenic water quality standard of 0.02 micrograms per liter (ug/L), which is applied state-wide. To comply with the 0.02 ug/L standard a monthly average arsenic effluent limit of 0.023 ug/L would need to be met at 75<sup>th</sup> Street WWTF, which is currently not achievable. Staff worked with the Division and Commission to adopt a Temporary Modification for arsenic which allows the WWTF to discharge arsenic at existing levels until the end of 2021.

In 2011 the city conducted a comprehensive evaluation of arsenic sources and determined that arsenic, in concentrations exceeding the 0.02 ug/L standard, is naturally occurring and present in the city's raw water sources. Arsenic has also been identified state-wide as a naturally occurring parameter above the 0.02 ug/L standard. In 2012 staff initiated the development of a state-wide arsenic work group which includes the Division and the U.S. Environmental Protection Agency (EPA). One goal of the work group is to re-evaluate the basis for the federal arsenic water quality standard, which was developed through the use of EPA's Integrated Risk Information System (IRIS) database.

In 2015 it was determined that the federal arsenic water quality standard should be re-calculated by modifying the human dietary assumptions used in the IRIS database. The current arsenic standard is based on dated dietary characteristics of people of the Asian Continent (low folic acid diet), and is not applicable to dietary characteristics of people in North America (higher folic acid diet). Higher folic acid intake, which is common world-wide outside of the Asian Continent, has shown to reduce the arsenic cancer risk. After adjusting for increased folic acid intake it is anticipated that the revised arsenic water quality standard will be one or two orders of magnitude higher and the resulting WWTF effluent will be attainable.

**Copper.** Since 2007, city staff have worked on developing and implementing a copper translator to increase the allowable discharge of copper from the 75<sup>th</sup> Street WWTF while still protecting aquatic life in Boulder Creek. In 2015 a copper translator was developed following EPA Guidance and accounts for the transformation of copper (from dissolved to total) below the WWTF, where the translator is expressed as a simple dissolved to total copper relationship. The translator study determined that a protective level of total copper could be 1.54 times the dissolved copper water quality standard applied to Boulder Creek.

On November 23, 2015, the Division issued a permit modification to the 75<sup>th</sup> Street WWTF CDPS discharge permit allowing the discharge of copper to be increased to 25.6 ug/L (as a 30-day average), compared to the proposed limit of 18 ug/L. The proposed daily maximum copper limit of 27 ug/L was removed and changed to a monitoring only requirement.

**Temperature - 2015 South Platte Basin Rulemaking Hearing Proposal.** Since issuing the May 2011 CDPS permit for the 75<sup>th</sup> Street WWTF, city staff have been actively involved in a stakeholder process with the Division to develop an alternative way to comply with proposed WWTF temperature effluent limits. The main area of concern is during the transition from the higher summer temperature water quality standard, which applies March through the end of November, to the much lower winter standard, which applies December through the end of February. The current application of the standards does not accurately reflect the natural transition between seasons and slow change in water temperature. The transition from the summer to winter standard creates a 50 percent reduction in the temperature standard, and WWTF effluent limit, from November 30 to December 1, each year.

In preparation for the June 2015 South Platte Basin Rulemaking Hearing, and development of a proposal, staff worked to develop a narrative standard for the summer to winter, and winter to summer, temperature transition season. The narrative standard would replace the numeric standard during the transition and rely on the narrative statement "Temperature will maintain a

normal pattern of seasonal fluctuations”. To help support the need for a narrative standard, or some other alternative, the city coordinated with Colorado Parks and Wildlife to collect fish data from Boulder Creek and completed a temperature treatment alternatives analysis with a consultant.

**Boulder Creek Fish Collections.** In August 2014, staff worked with Colorado Parks and Wildlife staff to collect and survey fish in Boulder Creek upstream and downstream of the 75<sup>th</sup> Street WWTF. Survey data were used to statistically evaluate similarities in fish populations and diversity upstream and downstream of the WWTF and determine potential impacts from WWTF effluent temperature. Results indicated that fish populations and diversity were statistically similar and that the WWTF effluent did not seem to have a negative impact. Fish data were also used to determine spawning periods for resident fish and evaluate the potential impacts of higher temperature in the beginning of the winter season. For all fish collected below the WWTF the spawning period is outside of the defined winter temperature standard season of December through February.

**Wastewater Temperature Treatment and Recovery Alternatives.** In 2014 staff worked with a consultant to evaluate options to remove or recover heat from wastewater in the collection system, prior to reaching the WWTF, and final effluent discharged from the WWTF. A total of 22 alternatives, grouped into three categories, were evaluated and advantages and disadvantages of each alternative were considered. The three categories and a summary of alternatives evaluated follows.

- 1) Upstream Cooling Methods - cooling and heat recovery in the wastewater collection system.
- 2) Wastewater Facility Cooling Methods – cooling and heat recovery in WWTF processes and effluent.
- 3) Direct Cooling Methods – cooling post WWTF effluent discharge.

Of the 22 alternatives, six were selected for a conceptual engineering evaluation including estimated costs, as shown in the table below.

**Wastewater Temperature Treatment Alternatives Description and Estimated Cost**

<b>Alternative Category</b>	<b>Alternative Description</b>	<b>Estimated Cost<sup>1</sup></b>
Upstream Cooling	Collection system interceptor routed through pond adjacent to WWTF to enhance heat transfer	\$18,500,00
Direct Cooling	Wetlands development – discharge WWTF effluent to wetlands for passive cooling	\$4,400,000
Wastewater Facility Cooling	Install 14 heat exchange units within WWTF process areas to recover and use heat for building heating	\$7,251,000
Direct Cooling	Spray ponds to disperse WWTF effluent into air to enhance heat transfer	\$3,584,000
Wastewater Facility Cooling	Cool effluent by routing effluent through evaporative cooling tower	\$5,600,000

Wastewater Facility Cooling	Convert existing abandoned trickling filter into a cooling tower to enhance evaporative cooling	\$5,200,000
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<sup>1</sup> Planning level capital cost with 20 percent contingency. Does not include annual operation and maintenance cost.

**Rulemaking Hearing Decision.** The Commission ultimately denied the city’s request for a narrative temperature standard for Boulder Creek at the June 2015 hearing and recommended the Division and stakeholders take additional time to further evaluate temperature standard transition season options. The Commission approved adopting a temperature standard Temporary Modification on Boulder Creek which will allow the 75<sup>th</sup> Street WWTF effluent to remain at the current temperature level December 31, 2020.

Staff continue to work on additional alternatives to address temperature compliance and will be presenting a proposal at the June 2016 Basic Standards Rulemaking Hearing.

### **Boulder Creek Nutrient Modeling**

In 2012 the Commission adopted nutrient controls under Regulation 85 – *Nutrients Management Control Regulation*, and the more restrictive instream Interim Nutrient Values under Regulation 31 – *Basic Standards for Surface Water*. In 2013 the city, in conjunction with the Colorado Monitoring Framework, received a grant from the Water Environment Research Foundation (WERF) to develop a water quality model and complete multiple nutrient management scenarios to estimate the effect on Boulder Creek from reducing 75<sup>th</sup> Street WWTF nutrient discharges.

Nutrient modeling included eight WWTF nutrient reduction scenarios and the evaluation of ecological response variables in Boulder Creek, including dissolved oxygen, pH, bottom algae chlorophyll-*a*, and benthic macroinvertebrates, all of which are known to be adversely affected by excessive nutrients. The eight nutrient modeling scenarios are shown below.

- 1) Existing WWTF Permitted Conditions – No additional nutrient removal.
- 2) Meet Regulation 85 Technology-based WWTF TIN and TP limits.
- 3) Attainment of dissolved oxygen (DO) and pH criteria at all locations in Boulder Creek below the WWTF.
- 4) Attain Regulation 31 Interim Nutrient Values for TN and TP in Boulder Creek.
- 5) Attainment of Regulation 31 Interim Nutrient Value for Chlorophyll-*a* in Boulder Creek.
- 6) Eliminate WWTP Nutrient Loads - Set WWTP Nutrient Concentrations to Zero.
- 7) Meet Mid-Range WWTF Nutrient Limits - Set WWTF Limits to 8 mg/L TN and 0.5 mg/L TP.
- 8) Set WWTF Limits to Limit of Technology Levels - 3 mg/L TN and 0.1 mg/L TP.

Based on the eight nutrient modeling scenarios the following major technical findings were identified.

- Under maximum permitted nutrient and BOD loadings, Boulder Creek was not

predicted to experience violations of DO criteria (< 5 mg/L).

- pH increases (above the water quality standard) in Boulder Creek downstream of the WWTF are due to both natural sources and bottom algae growth, and the pH standard cannot be consistently attained under any scenario.
- Regulation 31 Interim Nutrient Value for chlorophyll-*a* (150 mg/m<sup>2</sup>) is not consistently attainable at all locations in Boulder Creek.
- Attainment of all three Regulation 31 Interim Nutrient Values (chlorophyll-*a*, TN and TP) is not necessary to meet aquatic life uses at all locations in Boulder Creek.
- Attainment of pH criteria and Multi Metric Index (macroinvertebrates) thresholds at all locations in Boulder Creek would require extreme (and probably unattainable) nutrient reductions.
- Environmental benefits could be maximized with more phosphorus removal and less nitrogen removal than meeting Regulation 31 Interim Nutrient Values for TP and TN.

#### **NEXT STEPS:**

- Staff will continue to coordinate with the Division on the 75<sup>th</sup> Street CDPS permit renewal and provide comments on the draft permit once it is issued for Public Comment.
- Staff will also continue to prepare for the June 2016 Basic Standards Rulemaking Hearing, which will primarily focus on developing a site-specific approach to complying with Boulder Creek temperature standards.
- Staff will also provide WRAB updates in 2016 on the final CDPS permit requirements, if the permit is issued in 2016, and final decisions from the June 2016 Basic Standards Rulemaking Hearing that may affect future WWTF capital projects.
- In addition, WRAB will be provided updates on WWTF capital projects currently underway or included in the future CIP schedule. These projects include:
  1. Nitrogen Upgrades Project (achieving compliance with future ammonia, nitrate, and total inorganic nitrogen limits): Under construction, planned completion of January 2017.
  2. Phosphorus Removal Project (achieving compliance with total phosphorus per Regulation 85): In 6-year CIP schedule for design in 2019 and construction starting in 2020 (\$18,500,000 currently budgeted).

3. Regulation 31 Nutrient Removal Project (achieving compliance with future, very low total nitrogen, phosphorus, and chlorophyll-*a*): In the 20-year CIP schedule tentatively at year 2030 (\$11,000,000 currently budgeted).