

## Memorandum

To	Rob Court, City of Regina	Page	1
CC			
Subject	Bypass Flow at WWTP and MBPS		
From	Ed Wiebe		
Date	September 2, 2014	Project Number	60290169

### Background

Under normal operations, all untreated sewage from the City of Regina's wastewater collection system flows to the City's McCarthy Boulevard Pumping Station (MBPS) where it is mechanically screened and then pumped to the Wastewater Treatment Plant (WWTP).

The WWTP has a series of lagoons in which the main part of the wastewater treatment process occurs. The size of the lagoons includes some capacity to provide temporary storage for storm water flows. Under normal conditions, flow from the MBPS goes to the primary plant for grit and sludge removal and then to the lagoons for treatment. From the lagoons it is sent to the tertiary clarifiers for phosphorus removal and then to the ultraviolet (UV) facility for disinfection prior to being discharged to Wascana Creek.

### June Rainfall Events (Environment Canada Data)

The average rainfall for the month of June in Regina is approximately 75 mm. During June 2014, Regina received a total of 175 mm of rain, about 2.3 times the normal amount. In addition to all the small and medium sized rain events throughout the month, there were two significant rainfall events that occurred that month; the first was on June 18<sup>th</sup> with 34 mm of rainfall and the second occurred over June 29<sup>th</sup> and 30<sup>th</sup> with 92 mm.

### Bypass Events at Wastewater Treatment Plant

#### Timeline of Events

Due to the high rainfall event of June 18<sup>th</sup> and other rainfall events afterwards, the water levels in the lagoons were at very high levels and their capacity to handle additional storm water was limited. With the lagoon levels continuing to rise, the City, in communication with the Water Security Agency (WSA), began bypassing partially treated wastewater from the lagoons starting at about 2:40 pm on June 26<sup>th</sup>. The bypass was accomplished by diverting part of the flow from the lagoons that normally flows to the tertiary clarifiers. This lagoon bypass flow was blended with flow from the tertiary clarifiers and sent to the UV disinfection facility prior to being discharged to Wascana Creek.

In the early hours of June 30<sup>th</sup>, the WWTP began to receive high flows from MBPS, which meant that the City had to increase flow from the lagoons to the creek. Additionally, the City began bypassing flow from the tertiary clarifiers to the creek, bypassing the UV disinfection stage. The flow from the tertiary clarifiers was blended with the lagoon bypass flow and discharged directly to Wascana Creek. The goal of this procedure was to prevent the lagoon levels from increasing and overtopping the berms.

On July 3<sup>rd</sup>, the City set up additional portable pumps to help with draining the lagoon to the creek in an effort to speed up lowering of the lagoon levels. These pumps were removed on July 5<sup>th</sup> as the lagoon levels stabilized. On July 4<sup>th</sup>, flows from the tertiary clarifiers and part of the lagoon bypass were directed back to the UV disinfection facility. On July 5<sup>th</sup>, all of the lagoon bypass flow was directed back to the UV disinfection facility. On July 7, just after 11:00 am, the lagoon bypass valve was closed and normal WWTP operations were resumed.

### **Estimate of Amount Bypassed**

Based on flow meters and field measurements, the volume of partially treated wastewater that was bypassed to the creek was estimated as follows:

- Lagoon flow with UV treatment (blended with clarifier flow): 226.6 ML (226,600 m<sup>3</sup>)
- Lagoon flow with no UV treatment: 381.6 ML
- Tertiary clarifier flow with no UV treatment: 269.6 ML
- Total partially treated wastewater bypassed at WWTP: 877.8 ML

### **Effluent Quality at the WWTP Outfall**

The effluent from the WWTP entering Wascana Creek has to meet several water quality limits in order to meet the requirements of the Permit from the Water Security Agency of Saskatchewan (WSA). Most of these requirements are based on monthly averages. Although, the effluent during the bypass operations did experience elevated values for some parameters (e.g. total suspended solids, phosphorus, and *E.coli*), the monthly averages were within Permit levels for the month of June and July. Additionally, the Permit sets an absolute maximum level for *E.coli* of 1000 MPN/100 mL. The highest sample result for *E.coli* during the bypass operations was 770 MPN/100 mL (July 1<sup>st</sup>).

The Permit requirements for phosphorus are based on a six-month average and it won't be confirmed that the requirements for this parameter will be met until the end of December 2014. However, all indications are that the requirements will be met for phosphorus.

Full laboratory data is appended to this memorandum.

## **Bypass Events at McCarthy Boulevard Pumping Station**

## **Timeline of Events**

Due to high flows coming from the collection systems throughout the City, the sewage level in the inlet chamber at the MBPS rose sharply, overwhelming the capacity of the MBPS to pump to the WWTP. To minimize the risk of the collection system backing up and flooding basements, flow coming into the MBPS had to be bypassed directly to Wascana Creek. At approximately 2:30 pm on June 29<sup>th</sup>, the bypass valve was partially opened at the MBPS and screened wastewater was discharged directly to the creek as well as being pumped to the WWTP for treatment. The valve was throttled up and down over the course of the next two days based on the inlet chamber level. The purpose of throttling was to limit the volume bypassed to the creek while maintaining the integrity of the collection system.

Due to rising lagoon levels at the WWTP and continuing high flows from the collection system, the bypass valve at the MBPS was opened up further at about 1:15 pm on July 1<sup>st</sup>. This was to prevent the lagoons from over-topping. Over the course of the next day and a half, the bypass valve was throttled up and down to match the outflow at the WWTP. Just after 9:00 am on July 3<sup>rd</sup>, the bypass valve was closed and the MBPS returned to normal operations.

## **Notification of Bypass Event**

The Permit to Operate issued by WSA outlines the allowable conditions and required actions for a bypass at MBPS (Sections 3.6 and 3.7 of the Permit). As required by the Permit, the City immediately called the Spill Report Line and informed downstream water users as instructed by the WSA. The City collected sewage samples and kept the WSA informed on its courses of action throughout the bypass event.

## **Estimate of Amount Bypassed**

The flow through the bypass valve at MBPS is not metered. Flow was estimated from data obtained from the pumping station's control system and operator log. From this, the estimated amount of screened wastewater that was discharged to the creek was 265 ML (265,000 m<sup>3</sup>).

As noted above, bypassing at MBPS was necessary due to high flows in the collection system. The high flows were the result of significant rainfall entering the collections system, either directly or from sump pumps. As such, the wastewater in the collection system, and thus the wastewater that was bypassed to the creek, would have been of notably lower strength than under normal conditions due to dilution from the rainwater.

## **Quality of Bypass Flow at MBPS**

A concern with discharging wastewater directly from MBPS to Wascana Creek is bacteria in the wastewater. To address this concern, the City collected water samples from the creek upstream and downstream of the WWTP (the WWTP is downstream of the MBPS bypass discharge) while the bypass was occurring. The City had the samples analyzed for *E. coli* bacteria, which is the accepted means of examining water for indication of contamination with fecal bacteria and related organisms. At the height of the bypass operation, June 30<sup>th</sup>, the sample results were between 10,000 and 20,000 *E. coli* /100 mL (As a comparison, samples of the raw sewage flowing into the MBPS ranged from 200,000 to 2,000,000 *E. coli*/100 mL during the bypass operations). Over the course of the next few

days, the results dropped substantially. On July 5<sup>th</sup>, the results were around 200 *E. coli* /100 mL, meeting the Canadian Water Quality Guideline of 400 *E. coli* /100 mL for primary contact recreation (swimming).

*E. coli* live in the intestines of all warm-blooded animals, and their presence in streams can be expected even without contamination from human sewage, particularly in urban and agricultural areas that contain pets, livestock and waterbirds such as geese. During and after rainstorms that cause water to run off of land, concentrations of *E. coli* in streams can be particularly high and tend to be quite patchy. *E. coli* and other intestinal bacteria do not survive long once in streams and lakes, so occasional high concentrations associated with storms or runoff events indicate non-ideal conditions at those locations at those times; for this reason, it is recommended that recreational swimming areas be monitored frequently. Due to the temporal and spatial variability of *E. coli* and other bacteria, particularly during and after rainfall, it is not necessary to be concerned with the exact value of sampling results (e.g. 10,000 vs. 20,000 *E. coli* /100 mL), but rather the order of magnitude (e.g. results in the 10,000s vs. results in the 1,000s) and the duration of time that concentrations remain above desired levels. An informative discussion regarding *E. coli* bacteria, their analysis and use as indicators of water quality, establishment of guidelines, and suggested management of recreational waters can be found online under the Guidelines for Canadian Recreational Water Quality:

[http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/guide\\_water-2012-guide\\_eau/index-eng.php](http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/guide_water-2012-guide_eau/index-eng.php)

Effects of the MBPS bypass discharge as far downstream as the Qu'Appelle River are expected to be negligible due to dilution from other incoming flows and death of the bacteria in the stream. The maximum bypass flow that was discharged from the MBPS was approximately 2.3 cubic metres per second (m<sup>3</sup>/s) and the average was approximately 0.8 m<sup>3</sup>/s. Based on preliminary data provided by WSA, flows released from Wascana Lake into the creek (upstream of MBPS) were approximately 4 m<sup>3</sup>/s until June 27<sup>th</sup> 2014, increased from 14 m<sup>3</sup>/s to 21 m<sup>3</sup>/s on June 30<sup>th</sup>, peaked at 23 m<sup>3</sup>/s on July 1<sup>st</sup>, and remained above 9 m<sup>3</sup>/s until July 8<sup>th</sup> 2014. Flows in the creek near Lumsden (downstream of MBPS and WWTP) remained over 20 m<sup>3</sup>/s until July 6<sup>th</sup>, and flows in the Qu'Appelle River near Craven (just downstream of the river's confluence with Wascana Creek) were above or near 50 m<sup>3</sup>/s for approximately two weeks after peaking on July 1<sup>st</sup> 2014.

Once in freshwaters such as Wascana Creek, *E. coli* die off at a rate of approximately 50% per day, and do not reproduce. (See discussion and cited articles contained in the website address provided above.) Time of travel along Wascana Creek from MBPS to its confluence with the Qu'Appelle River is approximately two days (based on WSA estimates) and months in the Fishing Lakes on the Qu'Appelle River. As indicated in the laboratory data, some *E. coli* entered the Wascana Creek as a result of the MBPS bypass in the reaches immediately downstream of the MBPS. However, given the time of travel along Wascana Creek further downstream of MBPS and the extensive dilution that occurred at the same time, appreciable *E. coli* concentrations are not expected to have entered the Qu'Appelle system from the MBPS bypass, although loading of *E. coli* is expected to have occurred all along the creeks and river as a result of local overland runoff. Temporary elevations of *E. coli* concentrations in the water would be expected to subside following the runoff, except in areas where localized loading continues. As shown by the rapid decline in *E. coli* concentrations in Wascana Creek near the WWTP following the overflow event, cessation of loading from MBPS and the WWTP resulted in rapid recovery to normal conditions in the creek with respect to bacteria levels.

Full laboratory data is appended to this memorandum.