

Appendix J

**Short Term Erosion Monitoring Memos –
YCGSMP Water Quality Sampling Memo**

Memorandum

22 December 2020

| | | | |
|----------------|---|--------------------|-----------------|
| To | Jeff Doucette | | |
| Copy to | | | |
| From | Christine Pritchard | Tel | +1 519 884 0510 |
| Subject | Yellow Creek Geomorphic Systems Master Plan – Water Quality Sampling Component | Project no. | 11209954 |

1. Introduction

The Yellow Creek Geomorphic Systems Master Plan (YCGSMP) project comprises a comprehensive investigation of the factors that have contributed to substantial stream bed, bank and erosion control infrastructure damage within the Yellow Creek channel. The study area for this project includes the aboveground reach of Yellow Creek within the Vale of Avoca between Mount Pleasant Cemetery and the crossing near Mount Pleasant Road (**Figure 1**). The investigation will guide the development of a long-term rehabilitation plan for Yellow Creek that will protect Toronto Water infrastructure while minimizing riparian ecosystem impacts, and enhancing aquatic habitat. Work on the YCGSMP will take into consideration past and concurrent erosion control projects, assessments, and designs. The study will be completed within the framework of the Municipal Class Environmental Assessment process for Schedule B projects, with the integration of methodologies from the MNR *Adaptive Management of Stream Corridors* (2002) protocol.

As part of the background review and baseline data collection process, a water quality sampling program was established within Yellow Creek. Due to the timing of the sampling, these results have been included in the following technical memorandum, as an addendum to the Phase 2 Alternative Solutions report.

2. Method

Surface water grab samples within Yellow Creek were taken as per Section 2.11.1.4 of the RFP by GHD staff. Three (3) dry and three (3) wet weather grab samples were taken at the following locations over a three (3) month period from September to November 2020:

1. The source outfall.
2. Upstream of the three outfalls around St. Clair Avenue East bridge.
3. Immediately downstream of the three outfalls near the St. Clair Avenue East bridge.
4. Immediately upstream of the outfall at the rail bridge.
5. Immediately upstream of the point the stream goes underground at the downstream end of David A. Balfour Park.

6. At the closest discharge point into the Don River that is not impacted by Don River Flows (Yellow Creek outfall Asset ID #OF3753315532).

All samples were taken starting from the upstream locations and working downstream. Composite samples were created for each location by collecting three (3) equal volume grab samples over a ten-minute interval. Grab samples were obtained using a dipper pole to avoid unnecessarily disturbing the stream bottom. Grab sample bottles were transported within a cooler under Chain of Custody by GHD staff to Testmark Laboratories in Mississauga. Each sample was tested for the following parameters:

1. Total Suspended Solids (TSS)
2. Turbidity
3. pH
4. Conductivity

A handheld Hanna Multiparameter meter was also deployed at each site during the grab sample collection, with dissolved oxygen and temperature readings averaged over the ten-minute sampling interval.

To meet the conditions for a “dry” water quality sample, it was required that there had been no rainfall within the past 72 hours. Wet weather conditions were less strictly defined by the City of Toronto protocol, however due to the flashy nature of flows within this creek it was required that samples be taken as close to the conclusion of the precipitation event as possible, generally within eight (8) hours or less. “Wet” weather samples were collected following rain events of 8 mm or greater or during a significant snowmelt event. It was the intent to capture a range of wet weather flow conditions. At these times, flow conditions were visibly higher, to varying degrees, than during “dry” conditions. Samples were collected on the following dates:

- September 1, 2020 (dry event)
- September 17, 2020 (dry event)
- October 21, 2020 (wet event)
- November 6, 2020 (dry event)
- November 23, 2020 (wet event)
- November 26, 2020 (wet event)

3. Results

Laboratory and in-situ water quality results can be found in **Table 1** below.

Table 1 Yellow Creek Water Quality Sampling Results

| Sampling Date | TSS (mg/L) | Turbidity (NTU) | pH | Conductivity (uS/cm) | Dissolved Oxygen (mg/L) | Water Temperature (°C) | Comments |
|----------------|------------|-----------------|------|----------------------|-------------------------|------------------------|------------------------------|
| Source Outfall | | | | | | | |
| Sept 1, 2020 | 3.30 | 3.4 | 7.79 | 1750 | 8.90 | 17.0 | Dry event; mild turbidity |
| Sept 17, 2020 | 103 | 128.5 | 7.92 | 1800 | 6.75 | 15.3 | Dry event; water grey/turbid |
| Oct 21, 2020 | 233 | 250.0 | 7.58 | 245 | 10.49 | 14.3 | Wet event; water turbid |
| Nov 6, 2020 | 7.00 | 5.3 | 7.98 | 2050 | 7.92 | 13.9 | Dry event; slight turbidity |

| Sampling Date | TSS (mg/L) | Turbidity (NTU) | pH | Conductivity (uS/cm) | Dissolved Oxygen (mg/L) | Water Temperature (°C) | Comments |
|---|------------|-----------------|------|----------------------|-------------------------|------------------------|--|
| Nov 23, 2020 | 133 | 159.0 | 7.55 | 5590 | 9.36 | 10.0 | Wet event – following rain and snow melt; water turbid |
| Nov 26, 2020 | 4.70 | 5.3 | 7.99 | 1610 | 8.09 | 12.4 | Wet event; mild turbidity |
| Upstream of St. Clair Avenue East Bridge Outfalls | | | | | | | |
| Sept 1, 2020 | 7.0 | 5.9 | 7.91 | 1840 | 8.40 | 18.0 | Dry event; mild turbidity |
| Sept 17, 2020 | 2.3 | 2.0 | 7.92 | 1560 | 5.21 | 15.6 | Dry event; water clear |
| Oct 21, 2020 | 155.0 | 176.0 | 7.38 | 248 | 9.57 | 14.3 | Wet event; water turbid |
| Nov 6, 2020 | 4.3 | 6.8 | 7.91 | 2190 | 4.69 | 14.0 | Dry event; slight to moderate turbidity |
| Nov 23, 2020 | 100.0 | 141.0 | 7.54 | 5640 | 9.52 | 10.1 | Wet event – following rain and snow melt; water turbid |
| Nov 26, 2020 | 2.7 | 5.5 | 7.93 | 1420 | 7.77 | 11.9 | Wet event; mild turbidity |
| Downstream of St. Clair Avenue East Bridge Outfalls | | | | | | | |
| Sept 1, 2020 | 2.7 | 1.9 | 7.98 | 1780 | 8.90 | 18.0 | Dry event; water clear |
| Sept 17, 2020 | 1.3 | 1.2 | 7.96 | 1760 | 4.08 | 15.5 | Dry event; water clear |
| Oct 21, 2020 | 109.0 | 134.0 | 7.43 | 266 | 11.90 | 14.3 | Wet event; water turbid |
| Nov 6, 2020 | 14.3 | 14.1 | 7.93 | 1860 | 5.62 | 13.0 | Dry event; slight turbidity |
| Nov 23, 2020 | 62.0 | 93.0 | 7.51 | 5870 | 9.33 | 9.9 | Wet event – following rain and snow melt; water turbid |
| Nov 26, 2020 | 3.3 | 7.4 | 7.88 | 1320 | 9.08 | 11.2 | Wet event; mild turbidity |
| Upstream of Rail Bridge Outfall | | | | | | | |
| Sept 1, 2020 | 2.3 | 2.0 | 8.08 | 1730 | 9.40 | 20.0 | Dry event; water clear |
| Sept 17, 2020 | 1.70 | 1.7 | 8.01 | 1710 | 8.04 | 15.8 | Dry event; water clear |
| Oct 21, 2020 | 117.0 | 165.0 | 7.54 | 276 | 9.93 | 14.2 | Wet event; water turbid |
| Nov 6, 2020 | 1.70 | 1.9 | 8.01 | 1820 | 7.25 | 12.7 | Dry event; water clear |
| Nov 23, 2020 | 19.3 | 27.7 | 7.72 | 5300 | 10.78 | 8.9 | Wet event – following rain and snow melt; water turbid |
| Nov 26, 2020 | 2.0 | 7.0 | 7.83 | 1320 | 10.24 | 10.1 | Wet event; mild turbidity |

| Sampling Date | TSS (mg/L) | Turbidity (NTU) | pH | Conductivity (uS/cm) | Dissolved Oxygen (mg/L) | Water Temperature (°C) | Comments |
|---|------------|-----------------|------|----------------------|-------------------------|------------------------|--|
| Upstream of Point Stream Goes Underground | | | | | | | |
| Sept 1, 2020 | 3.0 | 2.5 | 8.14 | 1650 | 9.50 | 19.5 | Dry event; water clear |
| Sept 17, 2020 | 2.3 | 2.3 | 8.00 | 1600 | 7.15 | 15.6 | Dry event; water clear |
| Oct 21, 2020 | 100.0 | 139.0 | 7.49 | 284 | 9.86 | 14.1 | Wet event; water turbid |
| Nov 6, 2020 | 1.0 | 2.2 | 8.01 | 1750 | 7.64 | 12.1 | Dry event; water clear |
| Nov 23, 2020 | 11.7 | 19.0 | 7.79 | 4990 | 10.54 | 8.5 | Wet event – following rain and snow melt; water turbid |
| Nov 26, 2020 | 2.0 | 6.0 | 7.86 | 1340 | 8.80 | 9.9 | Wet event; mild turbidity |
| Yellow Creek Outfall Asset ID #OF3753315532 | | | | | | | |
| Sept 1, 2020 | 2.7 | 3.7 | 8.19 | 1620 | 9.30 | 18.0 | Dry event; water clear |
| Sept 17, 2020 | 3.0 | 3.3 | 8.05 | 1610 | 3.93 | 15.3 | Dry event; water clear |
| Oct 21, 2020 | 56.0 | 97.5 | 7.49 | 498 | 5.32 | 13.7 | Wet event; water turbid |
| Nov 6, 2020 | 2.3 | 3.8 | 8.07 | 1900 | 5.47 | 11.1 | Dry event; mild turbidity |
| Nov 23, 2020 | 22.0 | 30.6 | 7.72 | 5330 | 10.63 | 8.0 | Wet event – following rain and snow melt; water turbid |
| Nov 26, 2020 | 16.0 | 26.1 | 7.79 | 934 | 9.02 | 9.3 | Wet event; water turbid |

mg/L – milligrams per liter

NTU – Nephelometric Turbidity Unit

uS/cm – micro Siemens per centimeter

°C – degrees Celsius

The following range per measured parameter was observed:

- TSS – 1.0 mg/L to 233.0 mg/L
- Turbidity – 1.2 NTU to 250.0 NTU
- pH – 7.38 to 8.19
- Conductivity - 245 uS/cm to 5870 uS/cm
- Dissolved oxygen – 3.93 mg/L to 11.90 mg/L
- Temperature – 8.0°C to 20.0°C

4. Discussion

TSS under dry conditions ranged from 1.0 mg/L to 103.0 mg/L, with an average of 9.2 mg/L. The high TSS observed on September 17, 2020 was the result of very grey/turbid water discharging at the source outfall. This cleared by the next sampling location, upstream of the St Clair Avenue East bridge. Clarity was also slightly

impaired on the November 6, 2020 dry weather sampling event, with conditions clearing by just downstream of the St Clair Avenue East bridge. Turbidity values followed the same trend as the TSS values, with a dry event range of 1.2 NTU to 128.5 NTU, and an average of 11.5 NTU. During wet weather conditions, the TSS and turbidity were higher. A TSS range of 2.0 to 233.0 mg/L and turbidity range of 5.3 NTU to 250.0 NTU was observed, with average wet weather TSS of 63.8 mg/L and average turbidity of 82.7 NTU. However, it was apparent from visual observations on September 17 and November 6, 2020 that water clarity was not dependent on precipitation and that upstream land use/construction impact Yellow Creek periodically independent of weather.

pH did not vary notably between wet and dry weather events or between sites. Dry sampling found an average of 7.00 pH, while wet sampling resulted in an average of 7.66 pH. All observations fell within an acceptable pH for natural watercourses in Southern Ontario, which is 6.50 pH to 9.00 pH (CCME, 1999b).

Conductivity values did not appear to be dependent on the weather conditions as the wet and dry events had overlapping ranges. Values were also relatively similar between sites on their respective sampling dates. Dry sampling conditions resulted in a range of 1560 uS/cm to 2190 uS/cm, with an average of 1777 uS/cm. Conversely, a wider range was noted during wet weather events with values of 245 uS/cm to 5870 uS/cm, and an average of 2360 uS/cm. The highest conductivity occurred following the snow melt event on November 23, 2020. This would likely be influenced by salt content in the runoff.

Dissolved oxygen was measured in-situ during each sampling event using a handheld Hanna multiparameter meter. This meter was calibrated prior to use on each occasion. During the September 1, 2020 sampling the meter did not calibrate for dissolved oxygen, and subsequently required repair. As a result, the September 1, 2020 grab samples were submitted to Testmark for dissolved oxygen analysis. This was completed, with values included in Table 1, however Testmark advised that the testing was conducted outside of their recommended holding time for dissolved oxygen. While the results were within the range observed at the Yellow Creek site, these values have been excluded from the discussion below.

Dissolved oxygen under dry weather sampling conditions ranged between 3.93 mg/L and 8.04 mg/L, with an average of 6.15 mg/L. Dissolved oxygen was generally found to be higher during the wet weather sampling, with a range of 5.32 mg/L to 11.90 mg/L and an average of 9.46 mg/L. Dissolved oxygen was periodically quite variable between sites, and on multiple occasions it was locally found to be below a level that would support fish, particularly under dry conditions. The Canadian Water Quality Guidelines for the Protection of Aquatic Life indicate that fish in warm water thermal regimes in freshwater habitats are expected to require a minimum of 6 mg/L during early life stages, and 5.50 mg/L for other life stages (CCME, 1999a). In-situ measurements found values below 6.00 mg/L on two occasions at the site upstream of the St. Clair Avenue East bridge; twice downstream of the St. Clair Avenue East bridge; and three times at the Yellow Creek Outfall Asset ID #OF3753315532 where the watercourse emerges from a long underground piped reach. A fish sampling survey conducted by GHD in August 2020 did not find evidence of fish within Yellow Creek.

In-situ temperature measurements did not vary greatly between sites and were reflective of expected fall watercourse temperatures.

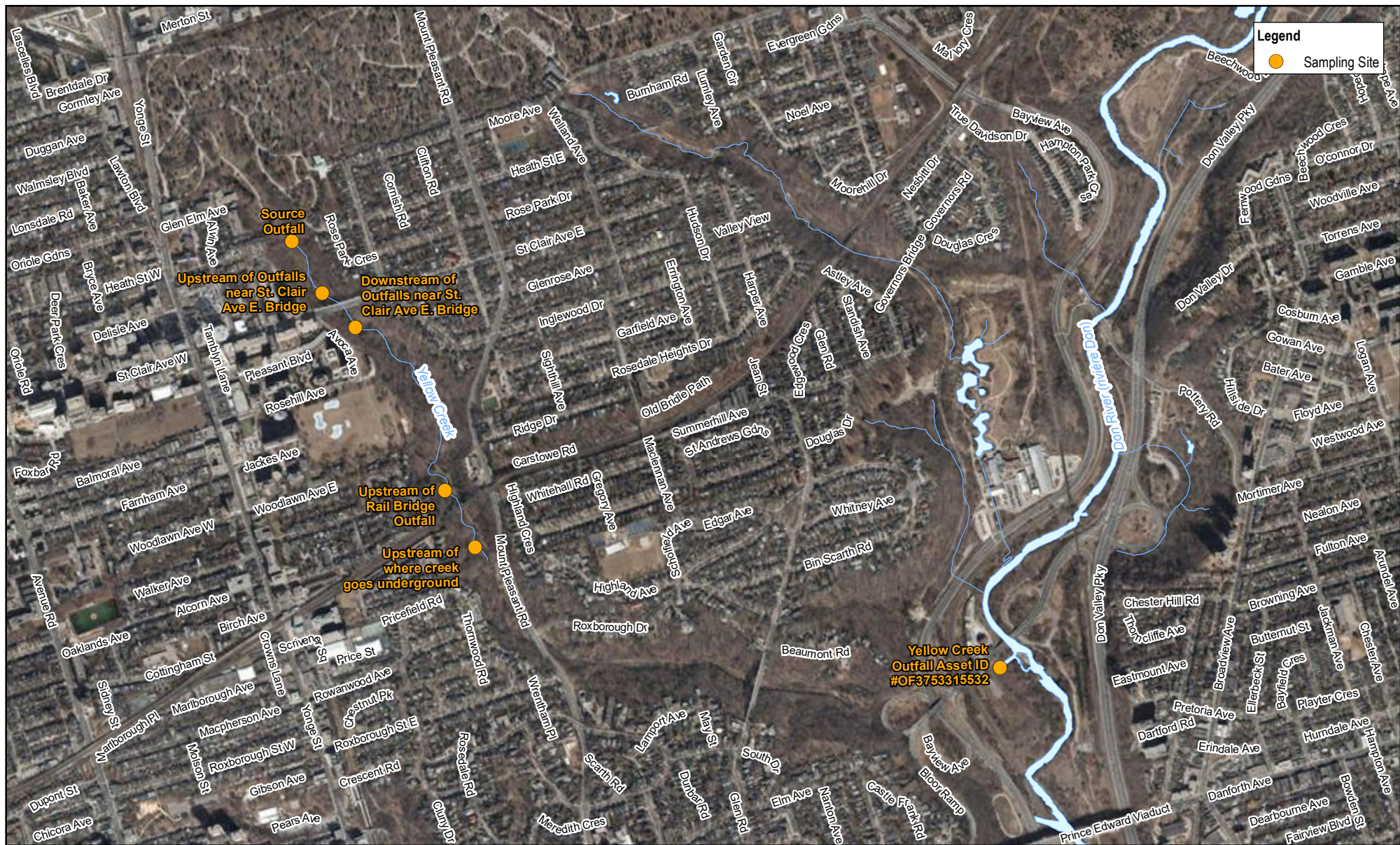
5. Conclusion

This technical memorandum provides a summary of baseline water quality conditions within the Yellow Creek study area as part of the YCGSMP project. Future rehabilitation efforts within the watercourse should keep in mind the varying levels of TSS, turbidity and conductivity due to upstream land use; and periodic low dissolved oxygen levels that are unsupportive of aquatic life.

6. References

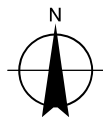
Canadian Council of Ministers of the Environment (CCME). 1999a. Canadian water quality guidelines for the protection of aquatic life: Dissolved oxygen (freshwater). In: Canadian environmental water quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

Canadian Council of Ministers of the Environment (CCME). 1999b. Water Quality Guidelines for the Protection of Aquatic Life.



Paper Size ANSI A
0 90 180 270 360
Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N



CITY OF TORONTO
YELLOW CREEK

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SAMPLING LOCATIONS

FIGURE 1