Addendum to 2020 Surface Water Quality Study near the Former GM Property
285 Ontario Street, City of St. Catharines

Technical Memorandum

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1.0 Introduction

In a January 29, 2020 letter from Shelley Chemnitz, Chief Administrative Officer, City of St. Catharines to Kim Groombridge, Manager Niagara District Office, Ministry of Environment, Conservation and Parks, the City of St. Catharines (City) requested that the Ministry of Environment, Conservation and Parks (MECP) assess any potential offsite environmental impacts including surface water from the former General Motors (GM) property located at 285 Ontario Street in the City of St. Catharines. The former GM property was previously a production facility and is located directly east of Twelve Mile Creek.

MECP Technical Support Surface Water completed surface water quality sampling related to the former GM West Plant (west side of Ontario Street) that included a former GM storm sewer outfall associated with the West Tilt Plate Separator, a City storm sewer outfall, and various upstream and downstream locations on Twelve Mile Creek during a snow melt event on February 13, 2020, a dry event on September 23, 2020 and a rain event on October 20, 2020. A December 11, 2020 MECP Technical Memorandum titled "2020 Surface Water Quality Study near the Former GM Property 285 Ontario Street, City of St. Catharines" provided the surface water quality sampling results and an interpretation of the results regarding potential surface water quality impact.

The Technical Memorandum (Spencer, 2020b) also identified that additional samples were collected during a rain event on December 1, 2020 related to the former GM West Plant. As well, samples were collected during a rain event on November 23, 2020 and a dry event on December 9, 2020 related to the former GM East Plant (east side of Ontario Street) that included a former GM storm sewer manhole associated with the East Tilt Plate Separator, a City storm sewer manhole, and an upstream and downstream location on Twelve Mile Creek.

This document provides an Addendum to the Technical Memorandum (Spencer, 2020b) to provide the surface water quality results and an interpretation of the results regarding potential surface water quality impact for the additional sampling completed on November 23, December 1 and December 9, 2020.

2.0 Background Information

An overview of Twelve Mile Creek and urban stormwater is contained in the previous Technical Memorandum (Spencer, 2020b).

3.0 Surface Water Quality Criteria

An overview of the surface water quality criteria incorporated into this Addendum is contained in the previous Technical Memorandum (Spencer, 2020b).

4.0 Sampling Locations

The surface water quality sampling locations represent locations related to the former GM West and East Plants.

Figure 1 illustrates the sampling locations related to the former GM West Plant and the following table provides a description of these locations:

GM West Plant Sample Locations	**Description**	**Sample Id**
GM West Outfall	Former GM storm sewer outfall associated with the West Tilt Plate Separator.	TMCOut1
City West Outfall	Municipal storm sewer outfall in line with Carlton Street.	TMCOut2

The City's main storm sewer in line with Carlton Street captures stormwater from Ontario Street and combined sewer overflows at the intersection of Carlton Street and Ontario Street. The main storm sewer then splits into two sewer pipes and two sewer outfalls that are contained in the same concrete outfall structure. The City West Outfall is the downstream outfall in the concrete outfall structure. The upstream outfall in the concrete outfall structure is not in service (Green, personal communication 2020) and was not sampled since it was always dry during all sampling events. Previous stormwater flows from the former GM East Plant (east side of Ontario Street) to the main storm sewer are believed to be capped (Green, personal communication 2020).

The previous Twelve Mile Creek sampling locations related to the former GM West Plant were not sampled for this Addendum since the Technical Memorandum (Spencer, 2020b) concluded that the previous sampling results for these locations were not considered a surface water concern.

Figure 2 illustrates the sampling locations related to the former GM East Plant and the storm sewer route to Twelve Mile Creek. The following table provides a description of these locations:

GM East Plant Sample Locations	**Description**	**Sample Id**
GM Manhole STE-53	Former GM storm sewer manhole associated with the East Tilt Plate Separator that drains to the City storm sewer on Thomas Street.	GM1
City Manhole Woodruff	Municipal storm sewer manhole in creek valley near Woodruff Avenue that collects upstream City stormwater including Lowell Avenue.	City2
TMC Upstream E	Twelve Mile Creek approximately 20 m upstream of the outfall from the City Manhole Woodruff.	TMC3US
TMC Downstream E	Twelve Mile Creek approximately 40 m downstream of the outfall from the City Manhole Woodruff.	TMC4DS

GM Manhole STE-53 drains to the City storm sewer on Thomas Street that drains to the City storm sewer on Lowell Avenue that eventually drains to the City Manhole Woodruff location before discharging to Twelve Mile Creek. The outfall from the City Manhole Woodruff was not sampled since the outfall was partially underwater due to the water level of Twelve Mile Creek.

The Twelve Mile Creek samples were collected approximately 2m from the shoreline using a sampling pole. While Twelve Mile Creek has a very large flow and mixing capacity in comparison to the storm sewer outfall flow, it is anticipated that the outfall discharge would flow along the shoreline while mixing for some distance due to the difference in flow and water quality.

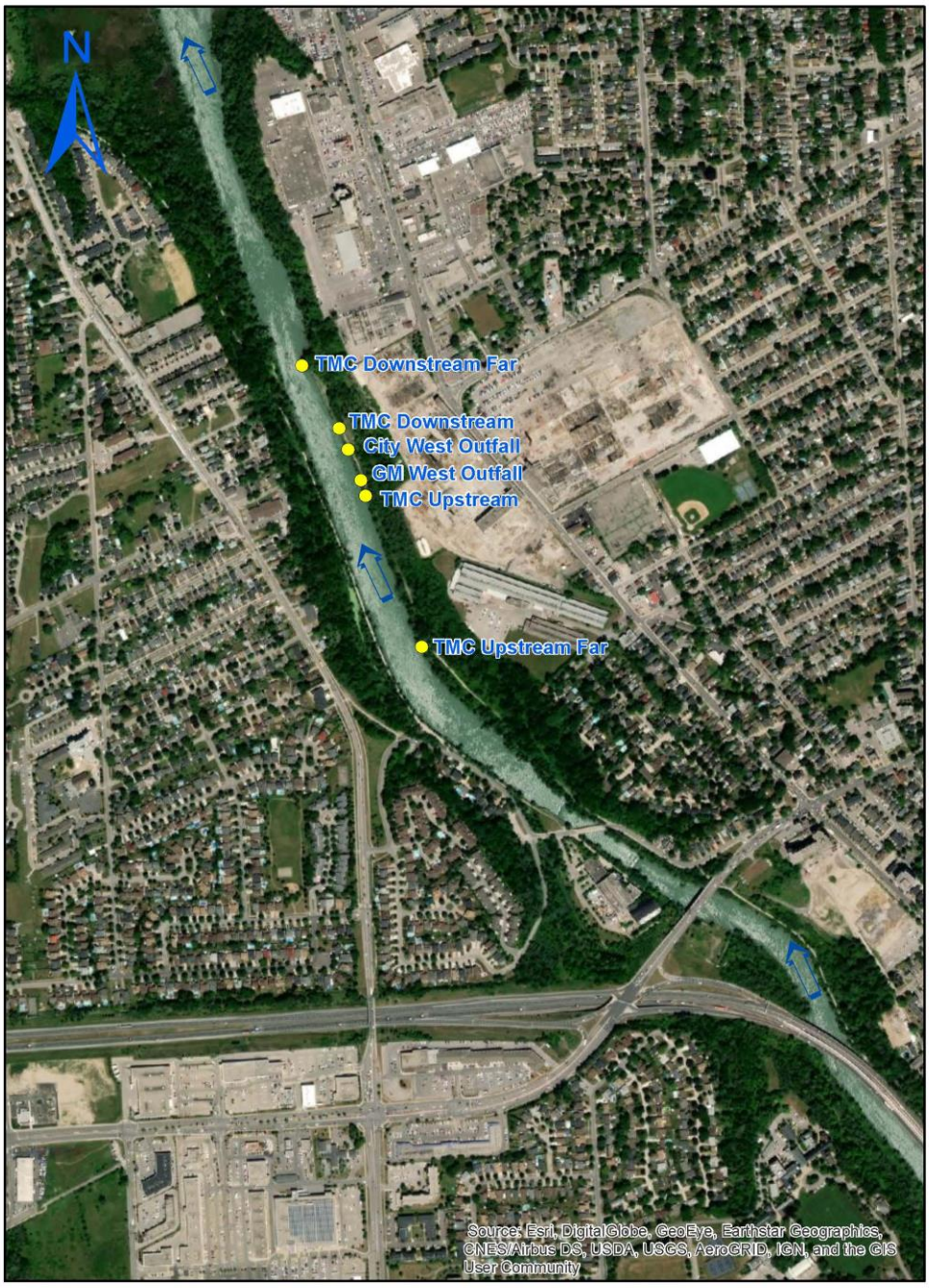


Figure 1: Sampling Locations Related to Former GM West Plant

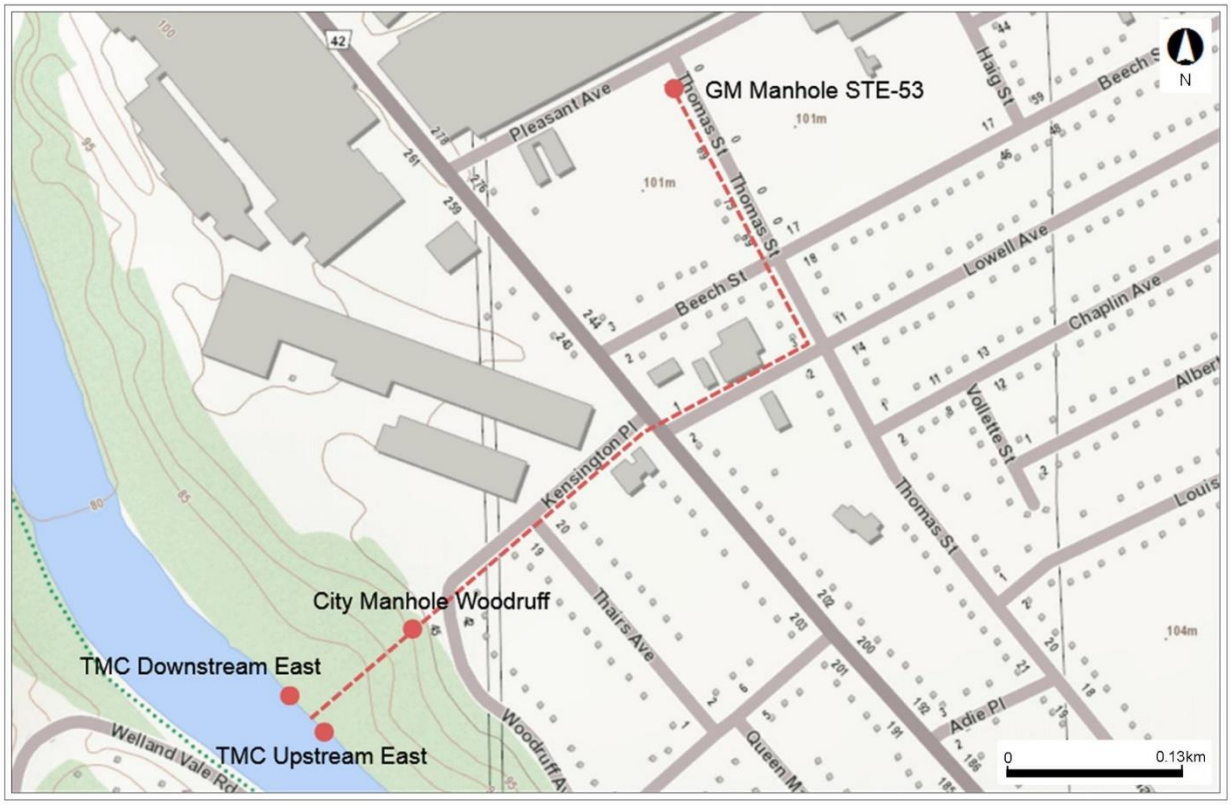


Figure 2: Sampling Locations Related to Former GM East Plant

5.0 Lab Analysis

The surface water quality samples related to the former GM West Plant were analyzed at the MECP lab for solids and polychlorinated biphenyls (PCB). Metals, volatile organic compounds (VOC), acid base neutrals (semi-volatiles), polycyclic aromatic hydrocarbons (PAH) and other general chemistry parameters were not analyzed since the Technical Memorandum (Spencer, 2020b) concluded that the previous results were within typical ranges for urban stormwater and were not considered a surface water concern.

The surface water quality samples related to the former GM East Plant were analyzed at the MECP lab for general chemistry (including solids), metals, VOCs, acid base neutrals (semi-volatiles), PAHs and PCBs. The wide range of analysis was chosen since the locations were not previously sampled.

6.0 Surface Water Quality Sampling Results

The following sections provide the surface water quality sampling results and interpretation related to the former GM West and East Plants.

6.1 Rain Event December 1, 2020 Results Related to Former GM West Plant

Rain event sampling related to the former GM West Plant was completed on December 1, 2020. The Niagara Peninsula Conservation Authority's Port Dalhousie Wastewater Treatment Plant precipitation gauge recorded 17.75 mm of precipitation in the 24 hours prior to sampling. The Lower Twelve Mile Creek flow on December 1, 2020 was approximately 214.5 m^3/s (214,500 L/s) based on the St. Lawrence Seaway Management Corporation recorded flow diversion from the Welland Canal system to the Decew Generating Station (Frick, personal communication 2021).

The rain event sampling results are contained in Table 1 and discussed below.

(i) Solids Results

The suspended solids results for the City West Outfall (31.6 mg/L) and GM West Outfall (non-detect <1 mg/L) were less than observed urban stormwater suspended solids concentrations (87 to 188 mg/L) in the MECP Stormwater Manual (MOE, 2003a). There is no PWQO for solids.

(ii) Polychlorinated Biphenyls Results

A discussion of the PCB results related to the former GM West Plant is provided in Section 7.0.

6.2 Rain Event November 23, 2020 Results Related to Former GM East Plant

The rain event sampling related to the former GM East Plant was completed on November 23, 2020. The Niagara Peninsula Conservation Authority's Port Dalhousie Wastewater Treatment Plant precipitation gauge recorded 16.25 mm of precipitation in the 24 hours prior to sampling. The Lower Twelve Mile Creek flow on November 23, 2020 was approximately 215.4 m^3/s (215,400 L/s) based on the St. Lawrence Seaway Management Corporation recorded flow diversion from the Welland Canal system to the Decew Generating Station (Frick, personal communication 2020).

The rain event sampling results are contained in Table 2 and discussed below.

(i) General Chemistry Results

Alkalinity results at the GM Manhole STE-53 (209 mg/L) and the City Manhole Woodruff (233 mg/L) were similar. The PWQO states that "Alkalinity should not be decreased by more than 25% of the natural concentration." The Twelve Mile Creek Upstream East (98.6 mg/L) and Downstream East (101 mg/L) results were similar.

Higher conductivity results were recorded at the GM Manhole STE-53 (856 uS/cm) and City Manhole Woodruff (1690 uS/cm) in comparison to the Twelve Mile Creek Upstream East (298 uS/cm) and Downstream East (300 uS/cm). There is no PWQO for conductivity. The higher conductivity results likely reflect the higher dissolved solids concentrations since conductivity is relatively sensitive to variations in dissolved solids concentrations. Urban runoff is expected to have elevated levels of solids from roads and construction sites (MOE, 2003a). As well, the higher dissolved solids concentrations likely reflect road salt residue. It is estimated that 97% of road salt used in Canada is in the form of sodium chloride (CCME, 2011). The sodium results for the GM Manhole STE-53 (40.5 mg/L) and the City Manhole Woodruff (184 mg/L) were also elevated in comparison to the Twelve Mile Creek locations (12.1 and 12.3 mg/L).

The pH results were within the PWQO range (6.5 to 8.5) at all the sampling locations.

The suspended solids results for the GM Manhole STE-53 (1.2 mg/L) and the City Manhole Woodruff (1 mg/L) were low and less than observed urban stormwater suspended solids concentrations (87 to 188 mg/L) in the MECP Stormwater Manual (MOE, 2003a). The Twelve Mile Creek Upstream East (21 mg/L) and Downstream East (19.9 mg/L) results were similar.

Overall, the rain event general chemistry results related to the former GM East Plant are not considered a surface water concern.

(ii) Metals Results

The GM Manhole STE-53 cadmium, chromium and uranium results exceeded the PWQO. As well, the City Manhole Woodruff copper and uranium results exceeded the

PWQO. The Twelve Mile Creek Upstream East and Downstream East aluminum results exceeded the PWQO.

Aluminum – The Twelve Mile Creek Upstream East (489 ug/L) and Downstream East (484 ug/L) aluminum results exceeded the PWQO (75 ug/L). However, the results were less than observed urban stormwater aluminum concentrations (1200 to 2500 ug/L) in the MECP Stormwater Manual (MOE, 2003a). The aluminum results were also within the range of wet event results for typical urban neighbourhoods in St. Catharines (135 to 528 ug/L at Walkers Creek at Lakeshore Road and Spring Garden Creek at Lakeshore Road) (Benoit and Dove, 2010). The results were also less than wet event results at the upstream reference site Twelve Mile Creek at 1st Street Louth (651 and 950 ug/L) (Benoit and Dove, 2010). The Twelve Mile Creek Trackdown Study (Benoit and Dove, 2010) identified that aluminum is likely found naturally at elevated levels in the watershed due to geological features. The GM Manhole STE-53 (18.3 ug/L) and the City Manhole Woodruff (7.1 ug/L) results were less than the PWQO.

Cadmium – The GM Manhole STE-53 cadmium result (0.847 ug/L) exceeded the PWQO (0.2 ug/L). However, the result was less than observed urban stormwater cadmium concentrations (1 to 24 ug/L) in the MECP Stormwater Manual (MOE, 2003a). The cadmium result was only slightly higher than the range of wet event results for typical urban neighbourhoods in St. Catharines (0 to 0.732 ug/L at Walkers Creek and Spring Garden Creek at Lakeshore Road) (Benoit and Dove, 2010). The City Manhole Woodruff, TMC Upstream E and TMC Downstream E results were all non-detect at the method detection limit (<0.5 ug/L).

Chromium – The GM Manhole STE-53 chromium result (1.75 ug/L) slightly exceeded the PWQO (1 ug/L). However, the result was within the range of wet event results for typical urban neighbourhoods in St. Catharines (0 to 2.32 ug/L at Walkers Creek and Spring Garden Creek at Lakeshores Road) (Benoit and Dove, 2010). The City Manhole Woodruff, Twelve Mile Creek Upstream East and Downstream East results were all non-detect at the method detection limit.

Copper – The City Manhole Woodruff copper result (6.61 ug/L) slightly exceeded the PWQO (5 ug/L). However, the result was less than observed urban stormwater copper concentrations (45 to 460 ug/L) in the MECP Stormwater Manual (MOE, 2003a). The result was also within the range of wet event results for typical urban neighbourhoods in St. Catharines (2.53 to 7.83 ug/L at Walkers Creek and Spring Garden Creek at Lakeshores Road) (Benoit and Dove, 2010). The GM Manhole STE-53 (4.16 ug/l), Twelve Mile Creek Upstream East (1.27 ug/L) and Downstream East (1.19 ug/L) results were less than the PWQO.

Uranium – The GM Manhole STE-53 (8.7 ug/L) and City Manhole Woodruff (15.9 ug/L) uranium results exceeded the PWQO (5 ug/L). However, the results can also be compared to the more recently developed long term (15 ug/L) and short term (33 ug/L) exposure Canadian Water Quality Guideline (CWQG). The long term exposure CWQG is intended to protect against negative effects to the aquatic ecosystem structure and

function during indefinite exposure similar to the PWQO. The short term exposure CWQG is intended to protect most species against lethality during transient events (ie. spills, infrequent releases). The GM Manhole STE-53 uranium result was less than the long term and short term exposure CWQG. The City Manhole Woodruff result slightly exceeded the long term exposure CWQG, however, it was less than the short term exposure CWQG. The metals results for typical urban neighbourhoods in St. Catharines (Walkers Creek and Spring Garden Creek at Lakeshores Road) did not include uranium analysis (Benoit and Dove, 2010). The Twelve Mile Creek Upstream East (4.75 ug/L) and Downstream East (4.64 ug/L) results were less than the PWQO.

Overall, the rain event metals results related to the former GM East Plant were within typical ranges for urban stormwater.

(iii) Volatile Organic Compounds Results

The GM Manhole STE-53 VOC results detected cis-1,2-dichloroethene (2.2 ug/L) and trichloroethene (3.1 ug/L) at less than their PWQO (200 and 20 ug/L respectively).

The City Manhole Woodruff, Twelve Mile Creek Upstream East and Downstream East VOC results were all non-detect at the method detection limits.

Overall, the rain event VOC results related to the former GM East Plant are not considered a surface water concern.

(iv) Acid Base Neutral (Semi-Volatile) Results

The GM Manhole STE-53 acid base neutral results were non-detect at the method detection limits, except di-n-octylphthalate (1.5 ug/L) was detected. There is no PWQO or CWQG for di-n-octylphthalate. The Di-n-octylphthalate Priority Substances List Assessment Report (Gov. of Can., 1993) identified that the lowest observed effect level for benthic invertebrates (*Daphnia magna)* was 1 mg/L (1000 ug/L) and the lowest observed effect level for fish (fathead minnow) was 10 mg/L (10,000 ug/L). The GM Manhole STE-53 di-n-octylphthalate detection was much lower than these lowest observed effect levels.

The City Manhole Woodruff, Twelve Mile Creek Upstream East and Downstream East acid base neutral results were all non-detect at the method detection limits.

Overall, the rain event acid base neutral results related to the former GM East Plant are not considered a surface water concern.

(v) Polycyclic Aromatic Hydrocarbons Results

The Twelve Mile Creek Upstream East PAH results were all non-detect at the method detection limit. The Twelve Mile Creek Downstream East results were non-detect at the

method detection limit, except benz(a)pyrene (2 ug/L) which was detected at less than the CWQG (15 ug/L).

The City Manhole Woodruff PAH results detected acenaphthene (16 ug/L) at less than the PWQO (30 ug/L), and phenanthrene (12 ug/L) less than the PWQO and the more recently developed CWQG (400 ug/L).

The GM Manhole STE-53 had eight detections of PAHs (anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, benzo(g,h,i)perylene, phenanthrene and pyrene) that either exceeded the PWQO and/or CWQG.

Anthracene – The GM Manhole STE-53 anthracene result (24 ng/L) exceeded the PWQO (0.8 ng/L) and the more recently developed CWQG (12 ng/L). However, the result was less than the Clifford Creek Park Upstream maximum result (32 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). The GM Manhole STE-53 result was below the method detection limit (31 ng/L) of typical urban stormwater from the residential feeder streets study (Selbig, 2009).

Benz(a)anthracene – The GM Manhole STE-53 benz(a)anthracene result (34 ng/L) exceeded the PWQO (0.4 ng/L) and the more recently developed CWQG (18 ng/L). However, the result was less than the Clifford Creek Park Upstream maximum result (56 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). As well, the result was less than typical urban stormwater from residential feeder streets (mean 180 ng/L) and collector streets (mean 390 ng/L) (Selbig, 2009).

Benzo(a)pyrene – The GM Manhole STE-53 benzo(a)pyrene result (36 ng/L) exceeded the CWQG (15 ng/L). However, the result was less than the Clifford Creek Park Upstream maximum result (110 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). As well, the result was less than typical urban stormwater concentrations from residential feeder streets (mean 290 ng/L) and collector streets (mean 620 ng/L) (Selbig, 2009).

Chrysene – The GM Manhole STE-53 chrysene result (41 ng/L) exceeded the PWQO (0.1 ng/L). However, the result was less than the Clifford Creek Park Upstream maximum result (140 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). As well, the result was less than typical urban stormwater concentrations from residential feeder streets (mean 230 ng/L) and collector streets (mean 660 ng/L) (Selbig, 2009).

Fluoranthene – The GM Manhole STE-53 fluoranthene result (120 ng/L) exceeded the PWQO (0.8 ng/L) and the more recently developed CWQG (40 ng/L). However, the result was less than the Clifford Creek Park Upstream maximum result (440 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). As well, the result was less than typical urban stormwater from

residential feeder streets (mean 640 ng/L) and collector streets (mean 1720 ng/L) (Selbig, 2009).

Benzo(g,h,i)perylene – The GM Manhole STE-53 benzo(g,h,i)perylene result (23 ng/L) exceeded the PWQO (0.02 ng/L). However, the result was less than the Clifford Creek Park Upstream maximum result (65 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). As well, the result was less than typical urban stormwater from residential feeder streets (mean 330 ng/L) and collector streets (mean 660 ng/L) (Selbig, 2009).

Phenanthrene – The GM Manhole STE-53 phenanthrene result (110 ng/L) exceeded the PWQO (30 ng/L), however, it was less than the more recently developed CWQG (400 ng/L). As well, the result was less than the Clifford Creek Park Upstream maximum result (220 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). The result was also less than typical urban stormwater from residential feeder streets (mean 310 ng/L) and collector streets (mean 780 ng/L) (Selbig, 2009).

Pyrene – The GM Manhole STE-53 pyrene result (91 ng/L) exceeded the CWQG (25 ng/L). However, the result was less than the Clifford Creek Park Upstream maximum result (330 ng/L) which was identified as less than the typical range found in urban watersheds for wet events (Benoit and Dove, 2010). As well, the result was less than typical urban stormwater from residential feeder streets (mean 500 ng/L) and collector streets (mean 1250 ng/L) (Selbig, 2009).

Overall, the rain event PAH results related to the former GM East Plant were within typical ranges for urban stormwater.

(vi) Polychlorinated Biphenyls Results

A discussion of the PCB results related to the former GM East Plant is provided in Section 7.0.

6.3 Dry Event December 9, 2020 Results Related to Former GM East Plant

The dry event sampling was completed on December 9, 2020 at the GM Manhole STE-53 for solids and PCBs. The Niagara Peninsula Conservation Authority's Port Dalhousie Wastewater Treatment Plant precipitation gauge recorded only 1.75 mm of precipitation in the 24 hours prior to sampling and previously had not recorded any precipitation since December 4, 2020. The Lower Twelve Mile Creek flow on December 9, 2020 was approximately 213.9 m^3/s (213,900 L/s) based on the St. Lawrence Seaway Management Corporation recorded flow diversion from the Welland Canal system to the Decew Generating Station (Frick, personal communication 2021).

The dry event sampling results related to the former GM East Plant are contained in Table 3 and discussed below.

(i) Solids Results

The GM Manhole STE-53 suspended solids result (2.8 mg/L) was low and less than observed urban stormwater suspended solids concentrations (87 to 188 mg/L) in the MECP Stormwater Manual (MOE, 2003a).

(ii) Polychlorinated Biphenyls Results

A discussion of the PCB results related to the former GM East Plant is provided in Section 7.0.

7.0 Overall PCB Sampling Results

7.1 PCB Results Related to Former GM West Plant

(i) City West Outfall PCB Results

The City West Outfall December 1, 2020 rain event total PCB result (14.6 ng/L) exceeded the PWQO (1 ng/L) and exceeded the PCB Threshold (10 ng/L). However, result was within the range of Twelve Mile Creek non-source sites for wet events (1.5 to 22.4 ng/L, average 9.5 ng/L) (Benoit et al., 2016).

The overall snow melt and rain events PCB results can be assessed together as wet events. Based on the PCB results collected to date during the snow melt (11.0 ng/L Feb. 13, 2020) and rain events (9.3 ng/L Oct. 20, 2020 and 14.6 ng/L Dec. 1, 2020), the City West Outfall total PCB average for wet events is 11.6 ng/L. The average only slightly exceeds the PCB Threshold and is within the range of Twelve Mile Creek non-source sites for wet events (Benoit et al., 2016).

The previous Technical Memorandum (Spencer, 2020b) also contained the September 23, 2020 dry event result. The City West Outfall dry event total PCB result (0.9 ng/L) was slightly less than the PWQO, less than the PCB Threshold and within the range of Twelve Mile Creek non-source sites for dry events (0.8 to 3.9 ng/L, average 2.0 ng/L) (Benoit et al., 2016).

Overall, the City West Outfall PCB results would be considered a non-source and reflect typical urban area concentrations.

(ii) GM West Outfall PCB Results

The GM West Outfall December 1, 2020 rain event total PCB result (55.9 ng/L) exceeded the PWQO (1 ng/L) and exceeded the PCB Threshold (10 ng/L). The result

also exceeded the range of Twelve Mile Creek non-source sites for wet events (1.5 to 22.4 ng/L, average 9.5 ng/L) (Benoit et al., 2016).

Based on the snow melt (15.6 ng/L Feb. 13, 2020) and rain events (23.7 ng/L Oct. 20, 2020 and 55.9 ng/L Dec. 1, 2020) PCB sampling results, the GM West Outfall total PCB average for wet events is 31.7 ng/L. The average exceeds the PCB Threshold and exceeds the range of Twelve Mile Creek non-source sites for wet events (Benoit et al., 2016).

The average is similar to the Station 206 (same outfall location) total PCB average of 34 ng/L for wet events for the 2003 sampling in the Twelve Mile Creek Trackdown Study (Benoit and Dove, 2010). However, Station 206 was a continuous discharge of both non-contact cooling water and stormwater in 2003 and currently the discharge is restricted to stormwater during wet events.

The previous Technical Memorandum (Spencer, 2020b) provided an overall Twelve Mile Creek watershed remediation perspective by comparing the GM West Outfall PCB results to other tributaries in various stages of remediation as follows.

(a) Beaver Dams Creek and the Lake Gibson area had average concentrations up to approximately 200 ng/L at some sampling locations (Benoit, personal communication 2020).

(b) Clifford Creek (related to Clifford Creek Park which was a former landfill site) had an average dry event concentration of 88 ng/L (range of 15 to 167 ng/L) and average wet event concentration of 458 ng/L (range of 144 to 795 ng/L) (Benoit and Dove, 2010).

(c) Carter Creek (related to Garden City Golf Course which was a former landfill site) had an average dry event concentration of 32 ng/L (range of 25 to 46 ng/L) and average wet event concentration of 93 ng/L (range of 50 to 131 ng/L) (Benoit and Dove, 2010).

In comparison to these Twelve Mile Creek tributaries, the GM West Outfall results are considered a less significant source. The GM West Outfall is not considered a continuous source like these other tributaries since it was not discharging during a September 23, 2020 dry sampling event. The GM West Outfall total PCB average wet event concentration is 31.7 ng/L versus 458 ng/L and 93 ng/L as noted for Clifford and Carter Creeks respectively. As well, it is anticipated that the PCB loading (kg/day) from the GM West Outfall to Twelve Mile Creek would be less since it is not a continuous discharge, is anticipated to have smaller discharge flows and the average wet event PCB concentration is lower.

It is my understanding that the current owner of the former GM property will be providing the MECP with a workplan outlining actions to be taken along with associated timelines to stop the source of PCB concentrations discharging from the site. The GM

West Outfall can be sampled after work has been completed to identify whether there is any reduction to PCB concentrations.

(iii) PCB Congener Patterns for GM West Outfall and City West Outfall

The PCB results can also be assessed for congener patterns. PCB congeners are any of 209 different molecules of varying degrees of chlorination that are found in PCB mixtures such as Aroclors. The water quality samples were analyzed by the MECP lab using a congener-specific PCB analysis method. From these results, congener patterns can be compared for similarities between sample events and sites. Congener-specific methods can differentiate between sources despite the degradation and weathering of the original PCB mixtures. As well, a comparison of congener profiles between sites can indicate whether the PCBs originate from a common source based on data and visual "fingerprinting" (Benoit et al., 2016).

As such, the congener patterns of the GM West Outfall and City West Outfall were assessed against typical congener profiles for common Aroclors as illustrated in Figure 3. While the outfalls contain a mixture of Aroclors, the primary is Aroclor 1248 with smaller proportions of Aroclors 1254 and 1260 (Benoit, personal communication 2021).

The GM West Outfall had higher PCB concentrations (15.6 to 55.9 ng/L) with lower suspended solids (<1 and 2.2 mg/L) which suggests minimal association of the PCBs with suspended solids. The GM West Outfall congener patterns were consistent with Aroclor 1248 and a small mix of Aroclor 1254 (Benoit, personal communication 2021).

The City West Outfall had lower PCB concentrations (9.3 to 14.6 ng/L) associated with higher suspended solids (2.2 to 31.6 mg/L) and contained more of a mixture of Arcolors 1248, 1254 and 1260. This congener pattern suggests a weathered PCB mixture associated with soils and sediments. The City West Outfall congener patterns were relatively consistent for all events (Benoit, personal communication 2021).

Overall, the PCB congener patterns between the GM West Outfall and City West Outfall appear different which suggests two different signatures or two different sources (Benoit, personal communication 2021).

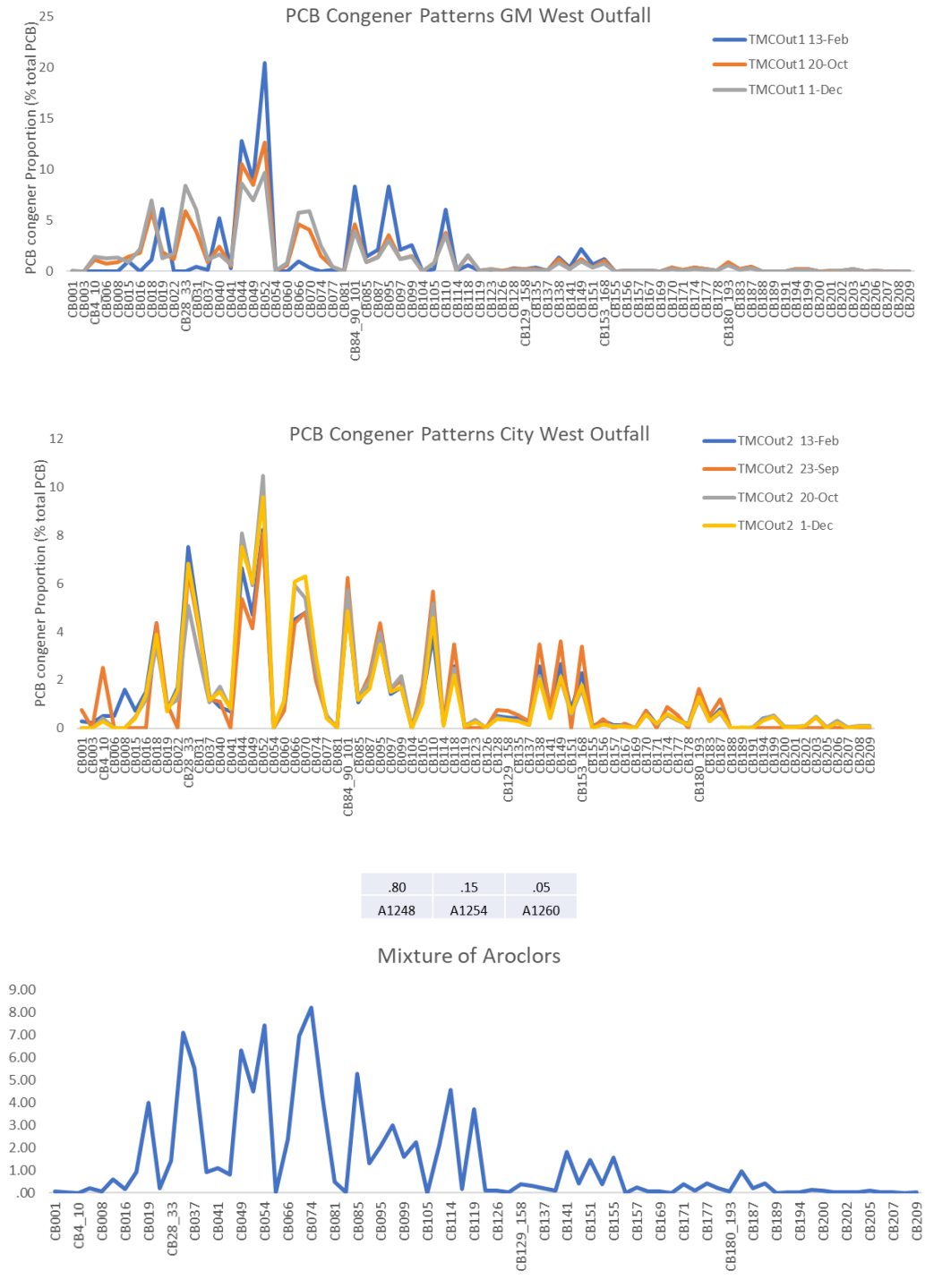


Figure 3: PCB Congener Patterns for GM West Outfall and City West Outfall
PCB congener pattern distribution (%) during snow melt, dry and rain events at GM West Outfall and City West Outfall. PCB congener pattern distributions (%) for Aroclors 1248, 1254 and 1260 presented for comparison purposes since they most closely resembled patterns at these locations. (Benoit, 2021)

7.2 PCB Results Related to Former GM East Plant

(i) GM Manhole STE-53 PCB Results

The November 23, 2020 rain event total PCB result for the GM Manhole STE-53 (908.1 ng/L) significantly exceeded the PWQO (1 ng/L) and the PWQO Threshold (10 ng/L). The December 9, 2020 dry event total PCB result (683.6 ng/L) also significantly exceeded the PWQO and the PWQO Threshold.

The GM Manhole STE-53 PCB results do not reflect typical urban area concentrations and would be considered a significant source. In comparison to the previous Technical Memorandum (Spencer, 2020b) discussion of overall Twelve Mile Creek watershed remediation perspectives as summarized in Section 7.2 above, the GM Manhole STE-53 PCB results exceeded the results from these other tributaries. As well, the GM Manhole STE-53 is considered a continuous source since it was discharging during the December 9, 2020 dry event sampling.

It is my understanding that the current owner of the former GM property will be providing the MECP with a workplan outlining actions to be taken along with associated timelines to stop the source of PCB concentrations discharging from the East Tilt Plate Separator. The GM Manhole STE-53 can be sampled after work has been completed to identify whether there is any reduction to PCB concentrations discharging from the site.

(ii) City Manhole Woodruff PCB Results

The November 23, 2020 rain event total PCB result for the City Manhole Woodruff (121.8 ng/L) significantly exceeded the PWQO (1 ng/L) and the PWQO Threshold (10 ng/L). The GM Manhole STE-53 discharges into the City storm sewer system which eventually connects to the City Manhole Woodruff before discharging to Twelve Mile Creek.

The City Manhole Woodruff PCB result does not reflect typical urban area concentrations and would be considered significant in comparison to the overall Twelve Mile Creek watershed remediation perspective as summarized in Section 7.2 above. The City Manhole Woodruff result exceeded the Carter Creek average wet event concentration of 93 ng/L (range of 50 to 131 ng/L) (Benoit and Dove, 2010). As well, since the GM Manhole STE-53 is considered a continuous source, the City Manhole Woodruff would also discharge continuously.

The City Manhole Woodruff was not sampled during the December 9, 2020 dry event sampling.

(iii) Twelve Mile Creek Upstream East and Downstream East PCB Results

The November 23, 2020 rain event total PCB results for Twelve Mile Creek Upstream East (2.5 ng/L) and Downstream East (2.7 ng/L) exceeded the PWQO (1 ng/L). However, the results were less than the PCB Threshold (10 ng/L). The Twelve Mile Creek Upstream East and Downstream East results were similar and do not identify an impact from the City Manhole Woodruff discharge. Overall, the Twelve Mile Creek results are not considered a surface water quality concern. That being said, a noticeable increase in PCB concentration in Twelve Mile Creek from the storm sewer outfall is not anticipated since the concentration in Twelve Mile Creek would likely be dominated by its very large flow in comparison to the much smaller flow from the storm sewer outfall.

The Twelve Mile Creek locations were not sampled during the December 9, 2020 dry event sampling.

(iv) PCB Congener Patterns for GM Manhole STE-53 and City Manhole Woodruff

The GM Manhole STE-53 (683.6 and 908.2 ng/L) and City Manhole Woodruff (121.8 ng/L) recorded the highest total PCB results in the study as illustrated in Figure 5.

The congener patterns of the GM Manhole STE-53 and the City Manhole Woodruff were assessed against typical congener profiles for common Aroclors as illustrated in Figure 4 (Benoit, personal communication 2021). The GM Manhole STE-53 and City Manhole Woodruff congener patterns are very similar and both resemble Aroclor 1248. The suspended solids results for the GM Manhole STE-53 (1.2 and 2.8 mg/L) and City Manhole Woodruff (1 mg/L) were low which suggests minimal association of the PCBs with suspended solids. Overall, the PCB congener patterns suggest a similar signature and similar source originating from the GM Manhole STE-53 (Benoit, personal communication 2021).

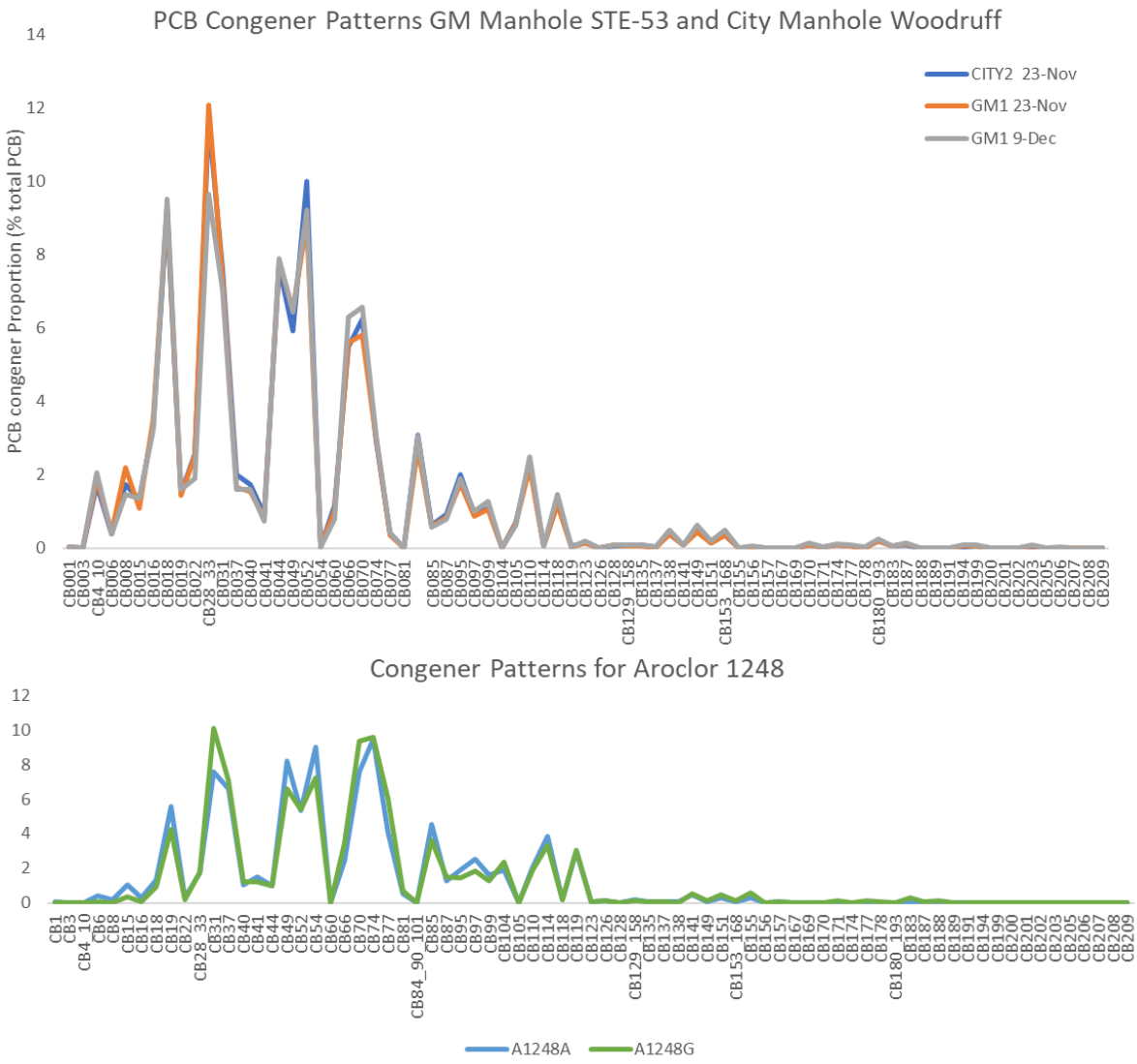
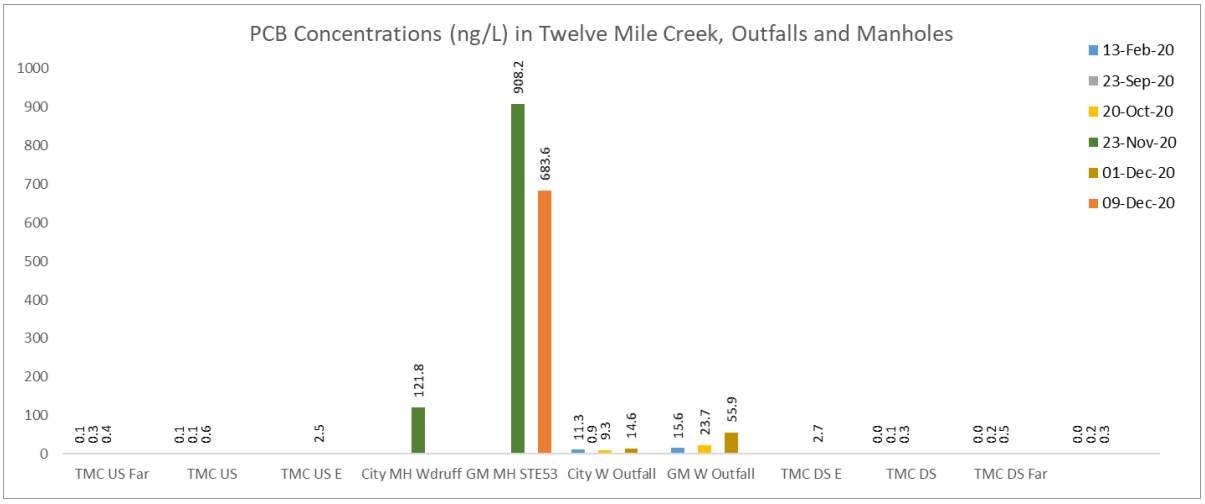


Figure 4: PCB Congener Patterns for GM Manhole STE-53 and City Manhole Woodruff
PCB congener pattern distribution (%) during dry and rain events at GM Manhole STE-53 and City Manhole Woodruff. PCB congener pattern distribution (%) for Aroclor 1248 presented for comparison purposes since it most closely resembled the pattern at these locations. (Benoit, 2021)



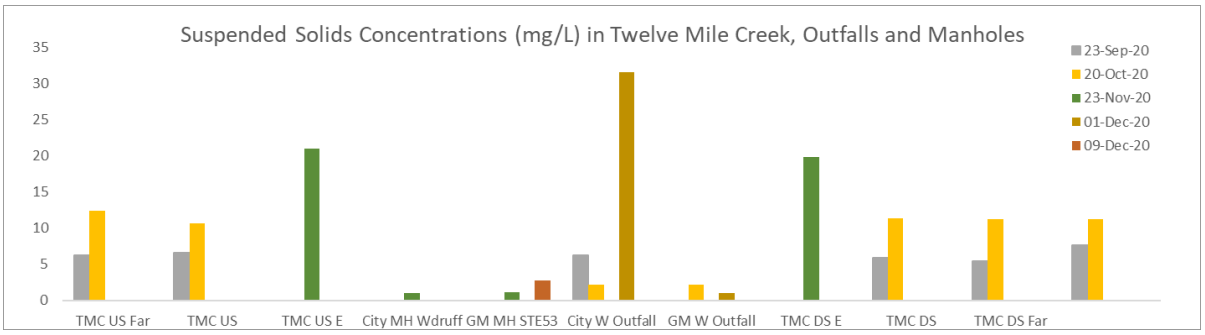


Figure 5: PCB and Suspended Solids Results for all Sampling Locations
(Benoit, 2021)

8.0 Conclusions

The City of St. Catharines requested that the MECP assess any potential offsite environmental impacts including surface water from the former General Motors property located at 285 Ontario Street in the City of St. Catharines. The MECP Technical Support Surface Water completed surface water quality sampling related to the former GM West Plant during a snow melt event on February 13, 2020, a dry event on September 23, 2020 and a rain event on October 20, 2020. The results of the sampling and interpretation was provided in a previous Technical Memorandum (Spencer, 2020b).

Additional surface water quality samples were collected during a rain event on December 1, 2020 related to the former GM West Plant. As well, samples were also collected during a rain event on November 23, 2020 and dry event on December 9, 2020 related to the former GM East Plant. This document provides an Addendum to the Technical Memorandum (Spencer, 2020b) to provide the additional surface water quality results and an interpretation of the results regarding potential surface water quality.

In regard to the former GM West Plant, the PCB congener patterns between the GM West Outfall and City West Outfall appear different which suggests two different signatures or two different sources. The City West Outfall had lower PCB concentrations associated with higher suspended solids and contained more of a mixture of Aroclors (Aroclors 1248, 1254 and 1260) which suggests a weathered PCB mixture associated with soils and sediments. The City West Outfall total PCB results would be considered a non-source and reflect typical urban area concentrations. The GM West Outfall had higher PCB concentrations with lower suspended solids which suggests minimal association of the PCBs with suspended solids. The GM West Outfall congener patterns were consistent with Aroclor 1248 and a small mix of Aroclor 1254. In comparison to the Twelve Mile Creek watershed remediation projects, the GM West Outfall PCB results are considered a less significant source.

In regard to the former GM East Plant, the GM Manhole STE-53, City Manhole Woodruff, Twelve Mile Creek Upstream East and Downstream East general chemistry, metals, volatile organic compounds, acid base neutrals (semi-volatile) and polycyclic aromatic hydrocarbons results are not considered a surface water concern or were within typical ranges for urban stormwater. As well, the Twelve Mile Creek PCB results are not considered a surface water quality concern.

The storm sewer samples for the GM Manhole STE-53 and City Manhole Woodruff recorded the highest total PCB results in the study. The GM Manhole STE-53 PCB results significantly exceeded the PWQO and the PWQO Threshold. As well, the results do not reflect typical urban area concentrations and would be considered a continuous significant source. The GM Manhole STE-53 discharges into the City storm sewer system which eventually connects to the City Manhole Woodruff before discharging to Twelve Mile Creek. The City Manhole Woodruff PCB result also did not reflect typical urban area concentrations and would be considered significant.

The GM Manhole STE-53 and the City Manhole Woodruff PCB congener patterns are very similar and both resemble Aroclor 1248. The suspended solids results for both locations were

low which suggests minimal association of the PCBs with suspended solids. Overall, the congener patterns suggest a similar signature and similar source originating from the GM Manhole STE-53.

9.0 Next Steps

Development of the former GM property has resumed and the current owner will be providing the MECP with a workplan outlining actions to be taken along with associated timelines to stop the source of PCB concentrations discharging from the site. I am supportive of this action. The surface water quality sampling locations related to the East and West Tilt Plate Separators should be sampled after the work plan activities acceptable to the MECP have been completed to identify if there has been any reduction in PCB concentrations discharging to the municipal storm sewer and ultimately to Twelve Mile Creek.

10.0 Acknowledgements

Thank you to the many participants for the sampling and review assistance for this Addendum including Kim Groombridge, Nadine Benoit, Linda Gabriele, Phil Hull, Greg Washuta and Mark Looker (MECP).

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Tables

Table 1: Rain Event December 1, 2020 Results Related to Former GM West Plant

Solids	Units	PWQO	GM West Outfall	City West Outfall
Suspended Solids	mg/L		<1	31.6
Total Solids	mg/L		488	2900
Dissolved Solids	mg/L		487	2860

Polychlorinated Biphenyls	Units	PWQO	GM West Outfall	City West Outfall
PCB congeners; total	ng/L	1	55.9018	14.6131
2-monochloroPCB(1)	pg/L		22	<8.3
4-monochloroPCB(3)	pg/L		<5.9	<9.1
2,3'-dichloroPCB(6)	pg/L		710	<12
2,4'-dichloroPCB(8)	pg/L		760	<40
4,4'-dichloroPCB(15)	pg/L		510	62
2,2',3-trichloroPCB(16)	pg/L		1200	200
2,2',5-trichloroPCB(18)	pg/L		3900	570
2,2',6-trichloroPCB(19)	pg/L		720	100
2,3,4'-trichloroPCB(22)	pg/L		960	230
2,4',5-trichloroPCB(31)	pg/L		3400	630
3,4,4'-trichloroPCB(37)	pg/L		640	170
2,2',3,3'-tetrachloroPCB(40)	pg/L		940	220
2,2',3,4-tetrachloroPCB(41)	pg/L		390	120
2,2',3,5'-tetrachloroPCB(44)	pg/L		4800	1100
2,2',4,5'-tetrachloroPCB(49)	pg/L		3900	880
2,2',5,5'-tetrachloroPCB(52)	pg/L		5400	1400
2,2',6,6'-tetrachloroPCB(54)	pg/L		27	7
2,3,4,4'-tetrachloroPCB(60)	pg/L		470	170
2,3',4,4'-tetrachloroPCB(66)	pg/L		3200	890
2,3',4',5-tetrachloroPCB(70)	pg/L		3300	920
2,4,4',5-tetrachloroPCB(74)	pg/L		1400	430
3,3',4,4'-tetrachloroPCB(77)	pg/L		230	59
3,4,4',5-tetrachloroPCB(81)	pg/L		8.3	5.5
PeClPCB(84)+PeCl(90)+PeCl(101)	pg/L		2200	710
2,2',3,4,4'-pentachloroPCB(85)	pg/L		480	170
2,2',3,4,5'-pentachloroPCB(87)	pg/L		740	240
2,2',3,5',6-pentachloroPCB(95)	pg/L		1700	510
2,2',3',4,5-pentachloroPCB(97)	pg/L		680	220
2,2',4,4',5-pentachloroPCB(99)	pg/L		800	250
2,2',4,6,6'-pentachloroPCB(104)	pg/L		<0.54	<0.6
2,3,3',4,4'-pentachloroPCB(105)	pg/L		460	150
2,3,3',4',6-pentachloroPCB(110)	pg/L		2000	670
2,3,4,4',5-pentachloroPCB(114)	pg/L		50	13
2,3',4,4',5-pentachloroPCB(118)	pg/L		880	320
2,3',4,4',6-pentachloroPCB(119)	pg/L		35	12
2',3,4,4',5-pentachloroPCB(123)	pg/L		110	37
3,3',4,4',5-pentachloroPCB(126)	pg/L		8.7	3
2,2',3,3',4,4'-hexachloroPCB(128)	pg/L		77	56
2,2',3,3',5,6'-hexachloroPCB(135)	pg/L		79	43
2,2',3,4,4',5-hexachloroPCB(137)	pg/L		24	19
2,2',3,4,4',5'-hexachloroPCB(138)	pg/L		450	300
2,2',3,4,5,5'-hexachloroPCB(141)	pg/L		110	62
2,2',3,4',5',6-hexachloroPCB(149)	pg/L		560	310
2,2',3,5,5',6-hexachloroPCB(151)	pg/L		190	93

2,2',4,4',6,6'-hexachloroPCB(155)	pg/L		<1	<0.8
2,3,3',4,4',5-hexachloroPCB(156)	pg/L		34	25
2,3,3',4,4',5'-hexachloroPCB(157)	pg/L		20	11
22'33'45(129)+233'44'6-HxClPCB(158)	pg/L		78	50
2,3',4,4',5,5'-hexachloroPCB(167)	pg/L		14	12
22'44'55'(153)+23'44'5'6-HxClPCB(168)	pg/L		410	260
3,3',4,4',5,5'-hexachloroPCB(169)	pg/L		<2	<4
2,2',3,3',4,4',5-heptachloroPCB(170)	pg/L		140	84
2,2',3,3',4,4',6-heptachloroPCB(171)	pg/L		42	26
2,2',3,3',4,5,6'-heptachloroPCB(174)	pg/L		130	87
2,2',3,3',4',5,6-heptachloroPCB(177)	pg/L		89	51
2,2',3,3',5,5',6-heptachloroPCB(178)	pg/L		31	19
2,2',3,4,4',5',6-heptachloroPCB(183)	pg/L		61	42
2,2',3,4',5,5',6-heptachloroPCB(187)	pg/L		170	100
2,2',3,4',5,6,6'-heptachloroPCB(188)	pg/L		<1	<2
2,3,3',4,4',5,5'-heptachloroPCB(189)	pg/L		6	4.3
2,3,3',4,4',5',6-heptachloroPCB(191)	pg/L		<5.3	<3.9
22'344'55'(180)+233'4'55'6-HpClPCB(193)	pg/L		320	190
2,2',3,3',4,4',5,5'-octachloroPCB(194)	pg/L		71	47
2,2',3,3',4,5,5',6'-octachloroPCB(199)	pg/L		92	67
2,2',3,3',4,5,6,6'-octachloroPCB(200)	pg/L		11	7.2
2,2',3,3',4,5',6,6'-octachloroPCB(201)	pg/L		13	6.9
2,2',3,3',5,5',6,6'-octachloroPCB(202)	pg/L		15	13
2,2',3,4,4',5,5',6-octachloroPCB(203)	pg/L		100	66
2,3,3',4,4',5,5',6-octachloroPCB(205)	pg/L		4.2	<3.8
22'33'44'55'6-nonachloroPCB(206)	pg/L		27	31
22'33'44'566'-nonachloroPCB(207)	pg/L		2.7	<2.9
22'33'455'66'-nonachloroPCB(208)	pg/L		5.2	9.7
DecachloroPCB(209)	pg/L		4.7	8.5
244'-triClPCB(28)+2'34-triClPCB(33)	pg/L		4700	1000
2,2'-dichloroPCB(4)+2,6-dichloroPCB(10)	pg/L		790	44

Exceeds PWQO

Note: "<value" means less than the method detection limit

Table 2: Rain Event November 23, 2020 Results Related to Former GM East Plant

General Chemistry	Units	PWQO	GM MH STE-53	City MH Woodruff	TMC Upstr E	TMC Downstr E
Alkalinity (CaCO3)	mg/L		209	233	98.6	101
Conductivity	uS/cm		856	1690	298	300
pH		6.5 - 8.5	8.11	8.28	8.22	8.23
Suspended Solids	mg/L		1.2	1	21	19.9
Total Solids	mg/L		606	1060	198	199
Dissolved Solids	mg/L		604	1060	177	179

Metals	Units	PWQO	CWQG	GM MH STE-53	City MH Woodruff	TMC Upstr E	TMC Downstr E
Arsenic	mg/L	0.1		<0.001	<0.001	<0.001	<0.001
Antimony	mg/L	0.02		0.0015	0.0009	0.0005	0.0005
Selenium	mg/L	0.1		<0.005	<0.005	<0.005	<0.005
Silver	ug/L	0.1		<0.5	<0.5	<0.5	<0.5
Aluminum	ug/L	75		18.3	7.1	489	484
Barium	ug/L			59.6	60.2	26.7	26.4
Beryllium	ug/L	1100		<0.1	<0.2	<0.1	<0.1
Bismuth	ug/L			<5	<10	<5	<5
Calcium	mg/L			89.8	113	32.9	33.1
Cadmium	ug/L	0.2		0.847	<0.5	<0.5	<0.5
Cobalt	ug/L	0.9		<1	<1	<1	<1
Chromium	ug/L	1		1.75	<2	<1	<1
Copper	ug/L	5		4.16	6.61	1.27	1.19
Iron	ug/L	300		110	30	337	330
Hardness	mg/L			348	418	120	120
Potassium	mg/L			12.7	7.53	1.72	1.72
Lithium	ug/L			15.3	<5	<5	<5
Magnesium	mg/L			30	32.9	9.08	9.12
Manganese	ug/L			26.6	3.28	17.2	16.9
Molybdenum	ug/L	40		3.5	1.3	0.9	0.9
Sodium	mg/L			40.5	184	12.1	12.3
Nickel	ug/L	25		5.36	8	<2	<2
Lead	ug/L	25		0.6	<0.5	0.5	0.5
Tin	ug/L			<9	<18	<9	<9
Strontium	ug/L			808	627	174	177
Titanium	ug/L			1.11	<1	17	17.1
Uranium	ug/L	5	15, 33	8.7	15.9	4.75	4.64
Vanadium	ug/L	6		<0.5	<0.5	1.08	1.09
Zinc	ug/L	30		16.7	15.8	2.46	2.42
Zirconium	ug/L	4		<1	<2	<1	<1

Exceeds PWQO and/or CWQG

Note: "<value" means less than the method detection limit

Volatile Organic Compounds	Units	PWQO	GM MH STE-53	City MH Woodruff	TMC Upstr E	TMC Downstr E
1,2-diethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2
1,2,4-trimethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2
1,3-diethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2
1,2,3-trimethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2
1,4-diethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2
1,3,5-trimethylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2
Benzene	ug/L	100	<0.2	<0.2	<0.2	<0.2
Isopropyl benzene	ug/L		<0.2	<0.2	<0.2	<0.2
Ethylbenzene	ug/L	8	<0.2	<0.2	<0.2	<0.2
2-ethyltoluene	ug/L		<0.2	<0.2	<0.2	<0.2
m- and p-xylene	ug/L	2, 30	<0.2	<0.2	<0.2	<0.2
o-xylene	ug/L	40	<0.2	<0.2	<0.2	<0.2
Isopropyl toluene	ug/L		<0.2	<0.2	<0.2	<0.2
Styrene	ug/L	4	<0.2	<0.2	<0.2	<0.2
Toluene	ug/L	0.8	<0.2	<0.2	<0.2	<0.2
3-ethyltoluene	ug/L		<0.2	<0.2	<0.2	<0.2
4-ethyltoluene	ug/L		<0.2	<0.2	<0.2	<0.2
Bromofluorobenzene	ug/L		<0.2	<0.2	<0.2	<0.2
d8-toluene	ug/L		<0.2	<0.2	<0.2	<0.2
Diisopropylether	ug/L		<0.2	<0.2	<0.2	<0.2
Fluorobenzene	ug/L		<0.2	<0.2	<0.2	<0.2
Methyl isobutyl ketone	ug/L		<0.2	<0.2	<0.2	<0.2
Tert-butyl methyl ether	ug/L		<0.2	<0.2	<0.2	<0.2
Propylbenzene	ug/L		<0.2	<0.2	<0.2	<0.2
Tetra-amyl-methyl ether	ug/L		<0.2	<0.2	<0.2	<0.2
1,1,1-trichloroethane	ug/L	10	<0.2	<0.2	<0.2	<0.2
1,1,2,2-tetrachloroethane	ug/L	70	<0.2	<0.2	<0.2	<0.2
1,1,1,2-tetrachloroethane	ug/L	20	<0.2	<0.2	<0.2	<0.2
1,1,2-trichloroethane	ug/L	800	<0.2	<0.2	<0.2	<0.2
1,1-dichloroethane	ug/L	200	<0.2	<0.2	<0.2	<0.2
1,1-dichloroethene	ug/L	40	<0.2	<0.2	<0.2	<0.2
1,2-dichloroethane	ug/L	100	<0.2	<0.2	<0.2	<0.2
1,2-dichloropropane	ug/L	0.7	<0.2	<0.2	<0.2	<0.2
cis-1,3-dichloropropene	ug/L		<0.2	<0.2	<0.2	<0.2
trans-1,3-dichloropropene	ug/L	7	<0.2	<0.2	<0.2	<0.2
Bromodichloromethane	ug/L	200	<0.2	<0.2	<0.2	<0.2
Bromomethane	ug/L	0.9	<0.5	<0.5	<0.5	<0.5
Bromoform	ug/L	60	<0.2	<0.2	<0.2	<0.2
Dibromochloromethane	ug/L		<0.2	<0.2	<0.2	<0.2
cis-1,2-dichloroethene	ug/L	200	2.2	<0.2	<0.2	<0.2
Chloroethane	ug/L		<0.5	<0.5	<0.5	<0.5
Chloromethane	ug/L	700	<0.5	<0.5	<0.5	<0.5
Chloroform	ug/L		<0.2	<0.2	<0.2	<0.2
Carbon tetrachloride	ug/L		<0.2	<0.2	<0.2	<0.2
Dichlorodifluoromethane	ug/L		<0.5	<0.5	<0.5	<0.5
Dichloromethane	ug/L		<0.2	<0.2	<0.2	<0.2
trans-1,2-dichloroethene	ug/L	200	<0.2	<0.2	<0.2	<0.2
Trichlorofluoromethane	ug/L		<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	ug/L	50	<0.2	<0.2	<0.2	<0.2
Trichloroethene	ug/L	20	3.1	<0.2	<0.2	<0.2
Chloroethene	ug/L		<0.2	<0.2	<0.2	<0.2
1,2-dichlorobenzene	ug/L	2.5	<0.2	<0.2	<0.2	<0.2
1,3-dichlorobenzene	ug/L	2.5	<0.2	<0.2	<0.2	<0.2
1,4-dichlorobenzene	ug/L	4	<0.2	<0.2	<0.2	<0.2
Chlorobenzene	ug/L	15	<0.2	<0.2	<0.2	<0.2
1,2-dibromoethane	ug/L		<0.2	<0.2	<0.2	<0.2
Trihalomethanes; total	ug/L		<0.2	<0.2	<0.2	<0.2
Xylenes; total	ug/L		<0.2	<0.2	<0.2	<0.2

Acid Base Neutrals (Semi-Volatiles)	Units	PWQO	CWQG	GM MH STE-53	City MH Woodruff	TMC Upstr E	TMC Downstr E
Diphenylamine	ug/L	3		<0.5	<0.5	<0.5	<0.5
2,4-dichlorophenol	ug/L	0.2		<0.5	<0.5	<0.5	<0.5
2,4-dinitrotoluene	ug/L	4		<0.5	<0.5	<0.5	<0.5
2,4-dimethylphenol	ug/L	10		<0.5	<0.5	<0.5	<0.5
2,4-dinitrophenol	ug/L			<10	<10	<10	<10
2,6-dichlorophenol	ug/L	0.2		<0.5	<0.5	<0.5	<0.5
2,6-dinitrotoluene	ug/L	6		<0.5	<0.5	<0.5	<0.5
4,6-dinitro-o-cresol	ug/L	0.2		<10	<10	<10	<10
4-bromophenyl-phenyl ether	ug/L	0.05		<0.5	<0.5	<0.5	<0.5
4-chlorophenyl-phenyl ether	ug/L	0.05		<0.5	<0.5	<0.5	<0.5
4-nitrophenol	ug/L	50		<0.5	<0.5	<0.5	<0.5
Bis(2-chloroethyl)ether	ug/L	200		<0.5	<0.5	<0.5	<0.5
Bis(2-chloroethoxy)methane	ug/L			<0.5	<0.5	<0.5	<0.5
Bis(2-chloroisopropyl)ether	ug/L			<0.5	<0.5	<0.5	<0.5
Butylbenzylphthalate	ug/L	0.2		<0.5	<0.5	<0.5	<0.5
Bis-2-ethylhexylphthalate	ug/L			<10	<10	<10	<10
Camphene	ug/L	2		<0.5	<0.5	<0.5	<0.5
Di-n-butylphthalate	ug/L	19		<10	<10	<10	<10
Di-n-octylphthalate	ug/L			1.5	<0.5	<0.5	<0.5
Diphenyl ether	ug/L	0.03		<0.5	<0.5	<0.5	<0.5
m-cresol	ug/L	1		<0.5	<0.5	<0.5	<0.5
N-nitroso-di-n-propylamine	ug/L			<0.5	<0.5	<0.5	<0.5
o-cresol	ug/L	1		<0.5	<0.5	<0.5	<0.5
p-chloro-m-cresol	ug/L			<0.5	<0.5	<0.5	<0.5
p-cresol	ug/L	1		<0.5	<0.5	<0.5	<0.5
Phenol	ug/L	5		<0.5	<0.5	<0.5	<0.5
1-chloronaphthalene	ug/L	0.1		<0.5	<0.5	<0.5	<0.5
1-methylnaphthalene	ug/L	2		<0.5	<0.5	<0.5	<0.5
2-chloronaphthalene	ug/L	0.2		<0.5	<0.5	<0.5	<0.5
2-methylnaphthalene	ug/L	2		<0.5	<0.5	<0.5	<0.5
5-nitroacenaphthene	ug/L			<0.5	<0.5	<0.5	<0.5
Acenaphthene	ug/L		5.8	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	ug/L			<0.5	<0.5	<0.5	<0.5
Anthracene	ug/L	0.0008		<0.5	<0.5	<0.5	<0.5
Benzo(a)anthracene	ug/L	0.0004		<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	ug/L		0.015	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	ug/L			<0.5	<0.5	<0.5	<0.5
Biphenyl	ug/L	0.2		<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	ug/L	0.0002		<0.5	<0.5	<0.5	<0.5
Chrysene	ug/L	0.0001		<0.5	<0.5	<0.5	<0.5
Dibenzo(a,h)anthracene	ug/L	0.002		<0.5	<0.5	<0.5	<0.5
Fluoranthene	ug/L	0.0008		<0.5	<0.5	<0.5	<0.5
Fluorene	ug/L	0.2		<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	ug/L	0.00002		<0.5	<0.5	<0.5	<0.5
Indole	ug/L			<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	ug/L			<0.5	<0.5	<0.5	<0.5
Naphthalene	ug/L	7		<0.5	<0.5	<0.5	<0.5
Perylene	ug/L	0.00007		<0.5	<0.5	<0.5	<0.5
Phenanthrene	ug/L	0.03		<0.5	<0.5	<0.5	<0.5
Pyrene	ug/L		0.025	<0.5	<0.5	<0.5	<0.5
2-chlorophenol	ug/L			<0.5	<0.5	<0.5	<0.5
2,3,4-trichlorophenol	ug/L	18		<0.5	<0.5	<0.5	<0.5
2,3,4,5-tetrachlorophenol	ug/L	1		<0.5	<0.5	<0.5	<0.5
2,3,4,6-tetrachlorophenol	ug/L	1		<0.5	<0.5	<0.5	<0.5
2,3,5-trichlorophenol	ug/L	18		<0.5	<0.5	<0.5	<0.5
2,3,5,6-tetrachlorophenol	ug/L	1		<0.5	<0.5	<0.5	<0.5
2,4,5-trichlorophenol	ug/L	18		<0.5	<0.5	<0.5	<0.5
2,4,6-trichlorophenol	ug/L	18		<0.5	<0.5	<0.5	<0.5
Pentachlorophenol	ug/L	0.5		<0.5	<0.5	<0.5	<0.5

Polycyclic Aromatic Hydrocarbons	Units	PWQO	CWQG	GM MH STE-53	City MH Woodruff	TMC Upstr E	TMC Downstr E
1-methylnaphthalene	ng/L	2000		<10	<10	<10	<10
2-methylnaphthalene	ng/L	2000		<10	<10	<10	<10
Acenaphthene	ng/L		5800	93	16	<10	<10
Acenaphthylene	ng/L			<10	14	<10	<10
Anthracene	ng/L	0.8	12	24	<10	<10	<10
Benz(a)anthracene	ng/L	0.4	18	34	<20	<20	<20
Benzo(a)pyrene	ng/L		15	36	<2	<2	2
Benzo(b)fluoranthene	ng/L			34	<10	<10	<10
Benzo(e)pyrene	ng/L			23	<10	<10	<10
Benzo(k)fluoranthene	ng/L			19	<10	<10	<10
Chrysene	ng/L	0.1		41	<10	<10	<10
Dibenz(a,h)anthracene	ng/L	2		<20	<20	<20	<20
Fluoranthene	ng/L	0.8	40	120	<10	<10	<10
Fluorene	ng/L	200	3000	110	<10	<10	<10
Benzo(g,h,i)perylene	ng/L	0.02		23	<20	<20	<20
Indeno(1,2,3-c,d)pyrene	ng/L			23	<20	<20	<20
Naphthalene	ng/L	7000	1100	20	<10	<10	<10
Perylene	ng/L	0.7		<10	<10	<10	<10
Phenanthrene	ng/L	30	400	110	12	<10	<10
Pyrene	ng/L		25	91	<10	<10	<10

Exceeds PWQO and/or CWQG

Notes: "<value" means less than the method detection limit

Polychlorinated Biphenyls	Units	PWQO	GM MH STE-53	City MH Woodruff	TMC Upstr E	TMC Downstr E
PCB congeners; total	ng/L	1	908.174	121.7613	2.4988	2.72371
2-monochloroPCB(1)	pg/L		370	41	<2.1	<5.8
4-monochloroPCB(3)	pg/L		130	18	<2.8	<4.4
2,3'-dichloroPCB(6)	pg/L		4100	450	<5.4	<6.5
2,4'-dichloroPCB(8)	pg/L		20000	2100	<19	<23
4,4'-dichloroPCB(15)	pg/L		10000	1600	<8.4	<14
2,2',3-trichloroPCB(16)	pg/L		32000	4000	<7.9	<12
2,2',5-trichloroPCB(18)	pg/L		85000	11000	<21	<32
2,2',6-trichloroPCB(19)	pg/L		13000	1800	<5.3	<7.9
2,3,4'-trichloroPCB(22)	pg/L		23000	3100	<6.8	<12
2,4',5-trichloroPCB(31)	pg/L		67000	9100	<21	<35
3,4,4'-trichloroPCB(37)	pg/L		15000	2400	<6.4	11
2,2',3,3'-tetrachloroPCB(40)	pg/L		14000	2100	<3.6	6.9
2,2',3,4-tetrachloroPCB(41)	pg/L		7500	1100	<3	4.2
2,2',3,5'-tetrachloroPCB(44)	pg/L		71000	9200	49	66
2,2',4,5'-tetrachloroPCB(49)	pg/L		59000	7100	34	44
2,2',5,5'-tetrachloroPCB(52)	pg/L		81000	12000	110	140
2,2',6,6'-tetrachloroPCB(54)	pg/L		320	44	<2	<1
2,3,4,4'-tetrachloroPCB(60)	pg/L		9500	1400	6.2	8.3
2,3',4,4'-tetrachloroPCB(66)	pg/L		51000	6600	36	49
2,3',4',5-tetrachloroPCB(70)	pg/L		53000	7500	88	100
2,4,4',5-tetrachloroPCB(74)	pg/L		27000	3500	24	30
3,3',4,4'-tetrachloroPCB(77)	pg/L		3300	500	3.6	5.3
3,4,4',5-tetrachloroPCB(81)	pg/L		150	20	<1.6	<2.2
PeClPCB(84)+PeCl(90)+PeCl(101)	pg/L		25000	3700	290	320
2,2',3,4,4'-pentachloroPCB(85)	pg/L		5400	760	40	42

2,2',3,4,5'-pentachloroPCB(87)	pg/L		7600	1100	120	120
2,2',3,5',6-pentachloroPCB(95)	pg/L		16000	2400	160	160
2,2',3',4,5-pentachloroPCB(97)	pg/L		8000	1100	74	80
2,2',4,4',5-pentachloroPCB(99)	pg/L		9600	1300	84	85
2,2',4,6,6'-pentachloroPCB(104)	pg/L		4	<1.6	<0.8	<2
2,3,3',4,4'-pentachloroPCB(105)	pg/L		6200	840	86	86
2,3,3',4',6-pentachloroPCB(110)	pg/L		20000	2800	270	290
2,3,4,4',5-pentachloroPCB(114)	pg/L		540	72	8.8	8.2
2,3',4,4',5-pentachloroPCB(118)	pg/L		11000	1500	190	200
2,3',4,4',6-pentachloroPCB(119)	pg/L		370	62	2.3	3.5
2',3,4,4',5-pentachloroPCB(123)	pg/L		1400	180	18	16
3,3',4,4',5-pentachloroPCB(126)	pg/L		50	9.8	<5	<3
2,2',3,3',4,4'-hexachloroPCB(128)	pg/L		730	91	44	47
2,2',3,3',5,6'-hexachloroPCB(135)	pg/L		610	100	23	25
2,2',3,4,4',5-hexachloroPCB(137)	pg/L		210	28	12	16
2,2',3,4,4',5'-hexachloroPCB(138)	pg/L		3500	480	180	190
2,2',3,4,5,5'-hexachloroPCB(141)	pg/L		800	110	29	35
2,2',3,4',5',6-hexachloroPCB(149)	pg/L		4000	580	150	150
2,2',3,5,5',6-hexachloroPCB(151)	pg/L		1300	180	35	34
2,2',4,4',6,6'-hexachloroPCB(155)	pg/L		<2	<0.53	<0.4	<0.39
2,3,3',4,4',5-hexachloroPCB(156)	pg/L		360	50	22	22
2,3,3',4,4',5'-hexachloroPCB(157)	pg/L		160	18	6.2	7.4
22'33'45(129)+233'44'6-HxClPCB(158)	pg/L		700	90	38	38
2,3',4,4',5,5'-hexachloroPCB(167)	pg/L		110	18	7.7	7.9
22'44'55'(153)+23'44'5'6-HxClPCB(168)	pg/L		3200	420	130	140
3,3',4,4',5,5'-hexachloroPCB(169)	pg/L		<5	<2	<1	<0.82
2,2',3,3',4,4',5-heptachloroPCB(170)	pg/L		820	100	18	18
2,2',3,3',4,4',6-heptachloroPCB(171)	pg/L		240	29	7	6.1
2,2',3,3',4,5,6'-heptachloroPCB(174)	pg/L		890	120	13	17
2,2',3,3',4',5,6-heptachloroPCB(177)	pg/L		500	65	9.4	9.5
2,2',3,3',5,5',6-heptachloroPCB(178)	pg/L		180	24	3.7	3.1
2,2',3,4,4',5',6-heptachloroPCB(183)	pg/L		1800	230	29	32
2,2',3,4',5,5',6-heptachloroPCB(187)	pg/L		490	61	9.4	8.4
2,2',3,4',5,6,6'-heptachloroPCB(188)	pg/L		980	120	14	16
2,3,3',4,4',5,5'-heptachloroPCB(189)	pg/L		<3	<0.7	<0.5	<0.7
2,3,3',4,4',5',6-heptachloroPCB(191)	pg/L		38	4.7	<1.2	<0.84
22'344'55'(180)+233'4'55'6-HpClPCB(193)	pg/L		39	4.9	<1.4	<0.81
2,2',3,3',4,4',5,5'-octachloroPCB(194)	pg/L		520	59	5.4	5.5
2,2',3,3',4,5,5',6'-octachloroPCB(199)	pg/L		560	71	6	6.6
2,2',3,3',4,5,6,6'-octachloroPCB(200)	pg/L		60	7.9	<1.1	<0.9
2,2',3,3',4,5',6,6'-octachloroPCB(201)	pg/L		58	6.2	<0.9	0.62
2,2',3,3',5,5',6,6'-octachloroPCB(202)	pg/L		69	8.8	1.5	<1.1
2,2',3,4,4',5,5',6-octachloroPCB(203)	pg/L		500	59	5.2	7.8
2,3,3',4,4',5,5',6-octachloroPCB(205)	pg/L		32	3.5	<0.5	0.79
22'33'44'55'6-nonachloroPCB(206)	pg/L		140	16	2.9	1.6
22'33'44'566'-nonachloroPCB(207)	pg/L		11	2	<0.5	<0.6
22'33'455'66'-nonachloroPCB(208)	pg/L		22	2.7	<0.63	<0.76
DecachloroPCB(209)	pg/L		11	4.8	3.5	3
244'-triClPCB(28)+2'34-triClPCB(33)	pg/L		110000	14000	<33	<52
2,2'-dichloroPCB(4)+2,6-dichloroPCB(10)	pg/L		17000	2100	<13	<17

Exceeds PWQO

Note: "<value" means less than the method detection limit

Table 3: Dry Event December 9, 2020 Results Related to Former GM East Plant

Solids	Units	PWQO	GM MH STE-53
Suspended Solids	mg/L		2.8
Total Solids	mg/L		821
Dissolved Solids	mg/L		818

Polychlorinated Biphenyls	Units	PWQO	GM MH STE-53
PCB congeners; total	ng/L	1	683.6012
2-monochloroPCB(1)	pg/L		270
4-monochloroPCB(3)	pg/L		90
2,3'-dichloroPCB(6)	pg/L		2700
2,4'-dichloroPCB(8)	pg/L		10000
4,4'-dichloroPCB(15)	pg/L		9300
2,2',3-trichloroPCB(16)	pg/L		22000
2,2',5-trichloroPCB(18)	pg/L		65000
2,2',6-trichloroPCB(19)	pg/L		11000
2,3,4'-trichloroPCB(22)	pg/L		13000
2,4',5-trichloroPCB(31)	pg/L		48000
3,4,4'-trichloroPCB(37)	pg/L		11000
2,2',3,3'-tetrachloroPCB(40)	pg/L		11000
2,2',3,4-tetrachloroPCB(41)	pg/L		5100
2,2',3,5'-tetrachloroPCB(44)	pg/L		54000
2,2',4,5'-tetrachloroPCB(49)	pg/L		44000
2,2',5,5'-tetrachloroPCB(52)	pg/L		63000
2,2',6,6'-tetrachloroPCB(54)	pg/L		240
2,3,4,4'-tetrachloroPCB(60)	pg/L		5500
2,3',4,4'-tetrachloroPCB(66)	pg/L		43000
2,3',4',5-tetrachloroPCB(70)	pg/L		45000
2,4,4',5-tetrachloroPCB(74)	pg/L		21000
3,3',4,4'-tetrachloroPCB(77)	pg/L		2800
3,4,4',5-tetrachloroPCB(81)	pg/L		83
PeClPCB(84)+PeCl(90)+PeCl(101)	pg/L		21000
2,2',3,4,4'-pentachloroPCB(85)	pg/L		4000
2,2',3,4,5'-pentachloroPCB(87)	pg/L		5500
2,2',3,5',6-pentachloroPCB(95)	pg/L		13000
2,2',3',4,5-pentachloroPCB(97)	pg/L		6900
2,2',4,4',5-pentachloroPCB(99)	pg/L		8700
2,2',4,6,6'-pentachloroPCB(104)	pg/L		4.8
2,3,3',4,4'-pentachloroPCB(105)	pg/L		4400
2,3,3',4',6-pentachloroPCB(110)	pg/L		17000
2,3,4,4',5-pentachloroPCB(114)	pg/L		390
2,3',4,4',5-pentachloroPCB(118)	pg/L		10000
2,3',4,4',6-pentachloroPCB(119)	pg/L		330
2',3,4,4',5-pentachloroPCB(123)	pg/L		1300
3,3',4,4',5-pentachloroPCB(126)	pg/L		32
2,2',3,3',4,4'-hexachloroPCB(128)	pg/L		650
2,2',3,3',5,6'-hexachloroPCB(135)	pg/L		670
2,2',3,4,4',5-hexachloroPCB(137)	pg/L		190
2,2',3,4,4',5'-hexachloroPCB(138)	pg/L		3400
2,2',3,4,5,5'-hexachloroPCB(141)	pg/L		710
2,2',3,4',5',6-hexachloroPCB(149)	pg/L		4400
2,2',3,5,5',6-hexachloroPCB(151)	pg/L		1300

2,2',4,4',6,6'-hexachloroPCB(155)	pg/L		<1.4
2,3,3',4,4',5-hexachloroPCB(156)	pg/L		360
2,3,3',4,4',5'-hexachloroPCB(157)	pg/L		150
22'33'45(129)+233'44'6-HxClPCB(158)	pg/L		570
2,3',4,4',5,5'-hexachloroPCB(167)	pg/L		110
22'44'55'(153)+23'44'5'6-HxClPCB(168)	pg/L		3300
3,3',4,4',5,5'-hexachloroPCB(169)	pg/L		<3
2,2',3,3',4,4',5-heptachloroPCB(170)	pg/L		910
2,2',3,3',4,4',6-heptachloroPCB(171)	pg/L		230
2,2',3,3',4,5,6'-heptachloroPCB(174)	pg/L		870
2,2',3,3',4',5,6-heptachloroPCB(177)	pg/L		530
2,2',3,3',5,5',6-heptachloroPCB(178)	pg/L		190
2,2',3,4,4',5',6-heptachloroPCB(183)	pg/L		450
2,2',3,4',5,5',6-heptachloroPCB(187)	pg/L		970
2,2',3,4',5,6,6'-heptachloroPCB(188)	pg/L		1.4
2,3,3',4,4',5,5'-heptachloroPCB(189)	pg/L		40
2,3,3',4,4',5',6-heptachloroPCB(191)	pg/L		40
22'344'55'(180)+233'4'55'6-HpClPCB(193)	pg/L		1800
2,2',3,3',4,4',5,5'-octachloroPCB(194)	pg/L		560
2,2',3,3',4,5,5',6'-octachloroPCB(199)	pg/L		600
2,2',3,3',4,5,6,6'-octachloroPCB(200)	pg/L		59
2,2',3,3',4,5',6,6'-octachloroPCB(201)	pg/L		58
2,2',3,3',5,5',6,6'-octachloroPCB(202)	pg/L		73
2,2',3,4,4',5,5',6-octachloroPCB(203)	pg/L		530
2,3,3',4,4',5,5',6-octachloroPCB(205)	pg/L		32
22'33'44'55'6-nonachloroPCB(206)	pg/L		160
22'33'44'566'-nonachloroPCB(207)	pg/L		13
22'33'455'66'-nonachloroPCB(208)	pg/L		24
DecachloroPCB(209)	pg/L		11
244'-triClPCB(28)+2'34-triClPCB(33)	pg/L		66000
2,2'-dichloroPCB(4)+2,6-dichloroPCB(10)	pg/L		14000

Exceeds PWQO

Note: "<value" means less than the method detection limit

Appendices

Appendix A: Certificates of Analysis

MECP lab certificates of analysis for the November 23 (C267852), December 1 (C268011) and December 9, 2020 (C268094) surface water quality sampling available upon request.