City of Winnipeg
2024 CSO Background

Environment Act Licence No. 3042

Clause 13

Prepared for

Environment and Climate Change

March 2025

City of Winnipeg CSO Background

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Table of Contents

Appendices

Tables

Figures

Acronyms and Abbreviations

AACE	American Association of Cost Engineers International
CEC	Clean Environment Commission
City	City of Winnipeg
CS	combined sewer
CSO	combined sewer overflow
DEP	district engineering plan
EA	Environment Act Licence
EMC	event mean concentrations
GI	green infrastructure
NEWPCC	North End Sewage Treatment Plant
No.	Number
NPRI	National Pollutant Release Inventory
O&M	operations and maintenance
PLUM	Planning and Land Use Model
PWWF	peak wet weather flow
P2	Pollution Prevention
RTC	real time control
SOIS	Sewer Overflow Information System
SRS	storm relief sewer
TP	total phosphorus
TN	total nitrogen
WSER	Wastewater Systems Effluent Regulations

1. Purpose

The operation of the City of Winnipeg (City)'s combined sewer overflow system is governed by Environment Act Licence (EA) No. 3042. To comply with Clause 13 of EA No. 3042, the City is required to submit an annual report documenting Combined Sewer Overflow (CSO) Master Plan implementation progress and work planned for the subsequent year by March 31 of each year (referred to throughout this document as the "annual report").

The CSO Background Information document provides an overview of the key considerations and historic reported changes of the CSO Master Plan. The information within this document is specific to the background information regarding the CSO annual report. For details about the changes and updates that have occurred for a particular year, refer to the corresponding year's annual report.

2. Combined Sewer Overflows

Combined sewer systems are sewers that are designed to collect both land drainage (rainwater and snowmelt) and wastewater (sewage from homes and businesses) in the same pipe. Most of the time, combined sewer systems transport all of the land drainage and wastewater to a sewage treatment plant, where it is treated and then discharged to the river. However, during periods of heavy rainfall or snowmelt, the additional volume in combined sewers systems can exceed the capacity of the sewer system. During these occasions, combined sewer systems are designed to overflow and discharge the excess volumes directly to the river without reaching the sewage treatment plant. These overflows, called combined sewer overflows (CSOs), contain not only land drainage, but also wastewater and debris.

Historically, combined sewers discharged directly to rivers. In the 1930s, diversion weirs were put in place to divert flows to the North End sewage treatment plant. The outfalls were retained to offer a level of protection against large wet weather events that could overload the system and result in basement flooding.

Combined sewers carry all of the wastewater flow to the sewage treatment plants during dry weather conditions. During periods of heavy rainfall or snowmelt, there is the potential for basement flooding due to high volumes of land drainage entering the sewer system. CSOs protect basements from flooding by relieving excess flow to the river.

About a third of the City's sewer system contains combined sewers. Typically, they were built before the 1960s and serve older areas of the city. Every time there is a CSO, there is a temporary discharge to the river of bacteria, floating debris, and organic material (nutrients). By reducing CSOs, we can do our part to help protect the health of our rivers and lakes.

3. Regulations

Combined sewers are regulated by federal and provincial requirements. On an annual basis, the City submits annual CSO discharge data to National Pollutant Release Inventory (NPRI), Wastewater Systems Effluent Regulation (WSER) and the Province to comply with both the federal and provincial regulations.

In 1999, the Federal Government required reporting on estimated sewerage lost from the sewer network under the Canadian Environmental Protection Act, as part of the NPRI.

In 2012, the Federal Government under WSER mandated the City to keep CSO records from 2013 and provide annual CSO Reporting due February 15 each subsequent year.

In 2013, the Province issued the first Combined Sewer Overflow Licence to the City of Winnipeg, EA No. 3042. It contained 16 clauses (see Appendix A) requiring public education, CSO reporting, interim water quality sampling and analysis, public notification and the development of a CSO Master Plan. The City of Winnipeg's responses to date concerning each of regulatory requirements contained within EA No. 3042 are listed below:

- The Public Education Plan was submitted to the Province in December 2013. This plan outlined a high-level schedule for public engagement activities to comply with Clause 9. The Province requested bi-annual report updates; this requirement was completed with the last report dated June 2019.
- The Combined Sewer Overflow Notification Plan was submitted to the Province in April 2014. This plan outlined the significant event, quarterly and annual CSO reporting processes to comply with Clause 14.
- The Interim Monitoring Plan was submitted to the Province in January 2014. This plan outlined the plans to comply with Clause 15 which concluded with the analysis of the samples collected documented in the submission of the December 2015 Preliminary Proposal submission.

- The CSO Public Notification System Plan was submitted to the Province in December 2015. This plan outlined a new notification system to inform the public in the event of an overflow to comply with Clause 10.

- The CSO Master Plan was submitted to the Province on August 28, 2019 (see section 4) and was subsequently approved by the Province on November 13, 2019 (see Appendix B). This triggered Clause 13 of EA No. 3042, which requires the City to submit an annual report documenting the CSO monitoring progress and results of the preceding year, and work plan for the subsequent year by March 31 of each year. Clause 13 specifically states:

The Licencee shall, upon approval of the Master Plan submitted pursuant to Clause 11 of this Licence, implement the plan such that progress towards meeting the required level of treatment is demonstrated annually by submission of an annual report, due March 31 of each year for the preceding calendar year. Annual submissions shall include the progress made on the plan pursuant to Clause 11 including monitoring results and the work plan for the subsequent calendar year.

The Provincial approval letter dated November 13, 2019 contained the following additional requirements:

a) The Licencee shall submit for approval an outline of the content of the annual report as required by Clause 13 of the Licence by December 31, 2019;

b) The Licencee shall, prior to submission of the annual report, submit a monitoring plan for approval;

c) The Licencee shall include in the annual report the monitoring report, the proposed planning for the year ahead, and the milestones achieved;

d) The Licencee shall, from the date of issue of this Letter, collect CSO water samples and model river quality data every 5 years to demonstrate improvements in the river water quality due to implementation of Control Option No. 1. The next river water quality report is due December 31, 2024;

e) The Licencee shall carry out an assessment of the impact of climate change to the performance of the CSO program and shall include the assessment report along with the CSO Master Plan for Control Option No. 2 which is due April 30, 2030; and

f) The Licencee shall, on or before April 30, 2025, submit for approval a report demonstrating that the percent capture performance measure, an alternative to Control Option No. 2 as proposed in the CSO Master Plan dated August 28, 2019, will provide equivalent water quality protection to Control Option No. 2 (i.e., four overflows in a representative year).

The City met with the Province to discuss the proposed outline for the CSO Master Plan annual reports on December 16, 2019. A proposed outline was submitted on December prior to the December 31 deadline.

On July 8, 2021, the Province requested the estimated increase and decrease in CSO volume as a result of small scale developments and infrastructure developments on the overall combined sewer system be documented in the annual report, see Appendix C. Refer to section 5.5 for further information.

The regulation changes in 2023 included the Removal of Requirement to submit Significant Rainfall Event Notifications, as per a Provincial letter received January 13, 2023 (Appendix D). As such, references to Significant Rainfall Event Notifications have been removed from the annual report.

4. CSO Master Plan History

Prior to establishment of the Federal and Provincial regulations summarized in Section 3, the City made major investments in wastewater treatment upgrades and focused on the combined sewer approach to eliminate dry weather overflows and protect the river water quality within Winnipeg. Projects that the City has invested in to relieve CSOs and protect basement flooding prior to the Federal and Provincial licensing requirements include:

- In 1937, diversion weirs and interceptor sewer system were put in place to divert combined sewer flows to the North End Sewage Treatment Plant (NEWPCC).
- Since 1960s, municipal regulations were in place to ensure that no new property developments were permitted to be serviced by combined sewers. All new developments must be serviced by a two-pipe system.
- The City also focused on completing infrastructure upgrades to eliminate CSOs to the river and reduce risks of basement flooding such as sewer separation works, sustainable drainage systems, latent storage dewatering stations, and outfall chamber upgrades.

After proclamation of the Environment Act on March 31, 1988, the Province of Manitoba requested the Clean Environment Commission (CEC) hold hearings on protecting Winnipeg's rivers and waterways. In 1992, the hearings concluded with recommendations to the City that a CSO study be commissioned. The CSO Management Strategy study was completed in 2002 and the final report was presented at the CEC public hearings completed in response to a raw sewage spill which occurred at the North End Sewage Treatment Plant (NEWPCC) in 2003. The 2002 CSO study documented the water quality impacts of combined sewers and formulated remedial measures for CSO control.

Following the 2003 CEC hearings, the CEC provided a report with advice and recommendations in August 2003. It was recommended in this report that the required funding to address CSOs in Winnipeg should be shared by the Federal and Provincial Governments in addition to the City. It was recommended the City be directed to complete the CSO work within the next 25 years, monitor CSOs

and implement a public notification system. An excerpt from this 2003 CEC report is shown below:

> *The City of Winnipeg should be directed to shorten the timeframe to complete its combined sewer overflow plan from the proposed 50 years to a 20 to 25-year period.*
>
> *The City of Winnipeg should be directed to take immediate action to reduce combined sewer overflows by instrumenting outfalls, adjusting weirs, accelerating combined sewer replacement, advancing the pilot retention project and undertaking other reasonable measures to reduce combined sewer overflows within two years.*

Based on the CEC recommendations, the Province issued EA No. 3042 on September 4, 2013, mandating the development of The City's Combined Sewer Overflow Master Plan.

In response to the Clause 11 Licence requirements the CSO Master Plan Preliminary Proposal was completed on December 18, 2015, recommending an 85% CSO volume capture long term control target. This proposal included plans, costs, evaluation criteria and recommendations for the five different targets to address CSOs. These targets are known as Control Options, and each of the five Control Option studied are listed below:

- Control Option 1: 85 Percent Capture in a Representative Year
- Control Option 2: Four Overflows in a Representative Year
- Control Option 3: Zero Overflows in a Representative Year
- Control Option 4: No More than Four Overflows per Year
- Control Option 5: Complete Sewer Separation

The Province responded to the City on November 24, 2017 with approval to the CSO Master Plan Preliminary Proposal. The letter specifically directed the City to:

- *Submit a Master Plan including detailed engineering plans, proposed monitoring plans, and an implementation schedule for Control Option No. 1 as identified in your CSO Master Plan Preliminary Proposal on or before August 31, 2019 and for Control Option No. 2 as identified in*

your CSO Master Plan Preliminary Proposal on or before April 30, 2030, and

- *Implement the CSO Master Plan for Control Option No. 1 by December 31, 2045, unless otherwise approved by the Director.*

On August 28, 2019, the City submitted the CSO Master Plan. The Master Plan included the District Engineering Plans (DEPs), proposed monitoring plans, and an implementation schedule for Control Option No. 1 with potential migration to Control Option No. 2.

Upon receipt of the CSO Master Plan submission, the Province responded to the City with the following requests on November 13, 2019:

- Part 1: complete an outline of the content of the annual report as required by Clause 13 of the Licence by December 31, 2019,
- Part 2: complete a monitoring plan for approval prior to the submission of the annual report, which will include the monitoring report, the proposed planning for the year ahead, and the milestones achieved,
- Part 3: complete a water quality assessment once every 5 years to demonstrate improvements in the river water quality as a result of implementation of Control Option No. 1. The next report is due December 31, 2029.
- Part 4: complete an assessment of the impact of climate change to the performance of the CSO program and an assessment report with the CSO Master Plan for Control Option No. 2, which is to be submitted by April 30, 2030,
- Part 5: complete a report demonstrating that the percent capture performance measure complies with Control Option No. 2, by April 30, 2025, and
- Part 6: implement CSO Master Plan for Control Option No. 1 by December 31, 2045.

The overview of the CSO Master Plan development timeline is illustrated in Figure 1.

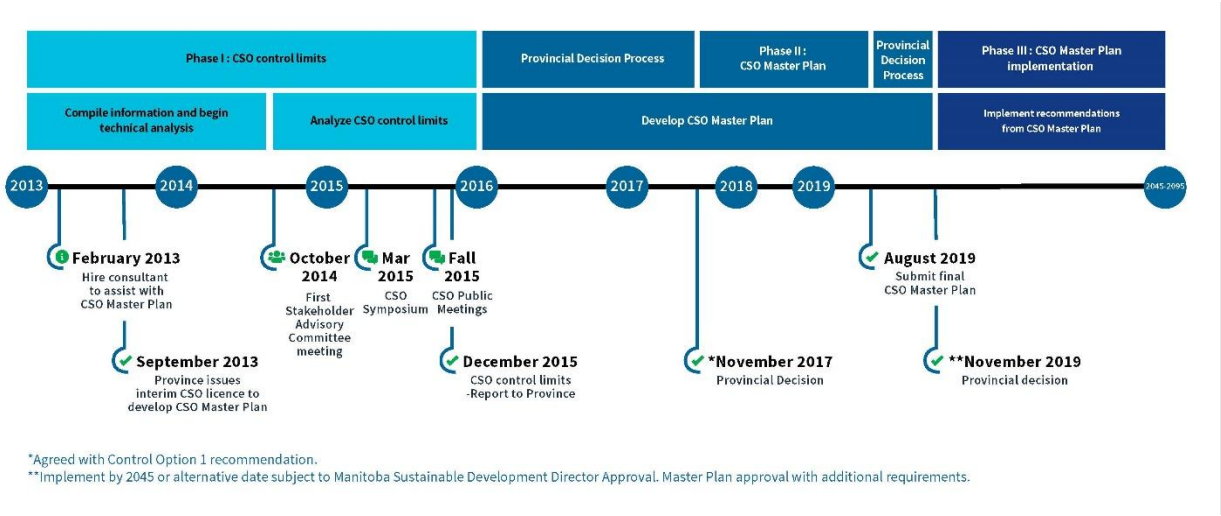

Figure 1 - CSO Master Plan Development Timeline

The CSO Master Plan began its implementation phase upon the receipt of the Provincial approval letter in November 2019. A high level CSO Master Plan Implementation timeline with a number of the future significant milestones is provided in Figure 2.

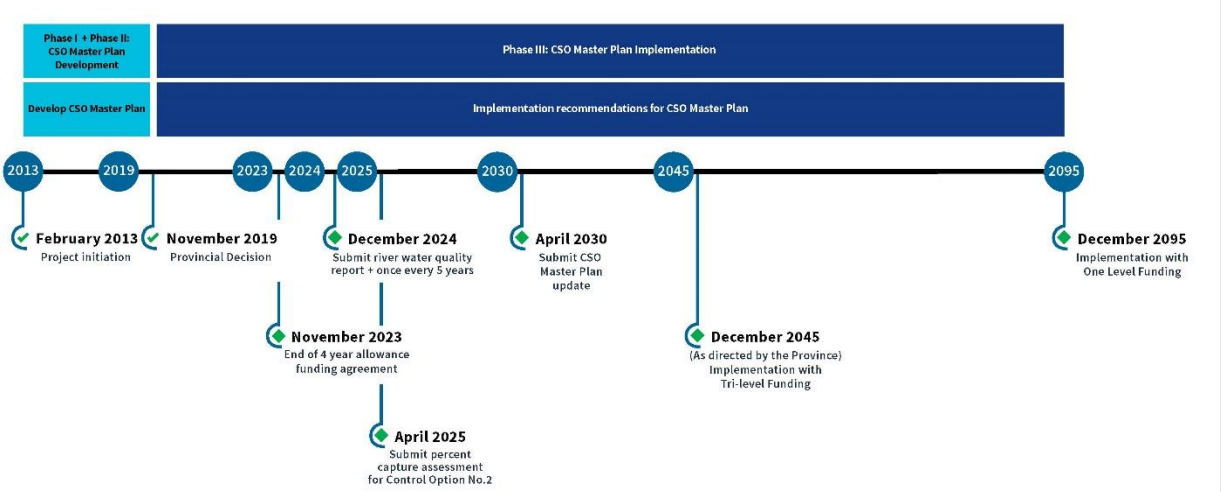

Figure 2 - CSO Master Plan Implementation Timeline

5. Master Plan Key Components

The following subsections identify the major considerations in the design of the CSO Master Plan to meet the requirements of EA No. 3042. These considerations will shape the reporting process for implementation of the CSO Master Plan.

5.1. Hydraulic Modelling

Monitoring instrumentation and analysis tools are crucial components to the development of the proposed solutions for the CSO Master Plan. At the beginning of the federally mandated CSO reporting period in 2002, no permanent CSO outfall instrumentation was in place. The estimation of percent sewerage volume lost from CSOs was solely based on analytical assumptions up until 2012. With the recommendation from the CEC in 2003, the City invested in CSO event monitoring and volume calculation tools to improve the confidence intervals of CSO estimations. The CSO Monitoring Program commenced in 2009 and by 2013, CSO instruments were successfully installed at 25 locations. Using the available data from the 25 monitored locations, the model estimates of wastewater flows from CSOs were validated.

Due to the difficulties of installing and maintaining instruments in harsh conditions with no local power source, detailed modeling of the combined sewer networks was undertaken to estimate the performance of the remaining combined sewer outfalls. An advanced hydraulic and hydrological model was built to represent the existing wastewater collections system. In 2014, the model was calibrated based on temporary instruments at five locations.

This model was further developed as more monitoring data became available. In 2015, the CSO Master Plan Regional Model was completed, which represented each of the CSO districts and outfalls. By 2015, CSO instruments were successfully installed in 14 additional combined sewer outfalls, bringing the total number of outfalls being monitored to 39. The model was then utilized to produce annual CSO results estimation with validation at the 39 permanent CSO instrumented locations.

In 2017, the City created a CSO overflow validation tool to identify and track differences between what the model estimated and the observed instrumented

overflows. This information was used to identify instrument maintenance, model maintenance, and areas for operational improvement.

In 2019, the City upgraded the hydraulic model from sewer systems to an integrated catchment modelling platform software to utilize the hydraulic software's latest and advanced features. Changes and impacts resulting from the software conversion process were documented.

In 2020 and 2021, CSO instruments were installed in three additional outfall locations each year. In 2022, one additional outfall location was monitored. The permanent CSO instrumented locations increased from 39 to 46 locations of the total 76 CSO outfalls.

5.2. Design Basis

The Preliminary Proposal recommended the Control Option No.1: 85 percent capture in a representative year. This option was the highest ranked of the control options considered in the study and was later approved by the Province in 2017.

5.3. Representative Year

The CSO Master Plan adopted the year 1992 as the representative year for annual rainfall intensities and river levels. Based on a detailed review of 53 years of historic rainfall records at the Winnipeg International Airport, it was determined that the year 1992 would be a suitable rainfall year to be representative of typical conditions with respect to accumulated rainfall (i.e. mm per event), number of annual events, and total annual precipitation characteristics.

Similar evaluations of the historic river level records were completed and determined that the year 1992 could also be suitable as representative of typical river level conditions in Winnipeg. As such, the 1992 river level trends and rainfall intensities were used in sophisticated numerical modeling to estimate the volume and frequency of CSO events during the recreation season (May through September, inclusive). It was agreed with the Province as part of the CSO Master Plan Preliminary Proposal development that the year 1992 would form the representative year and would be utilized for planning and evaluation of current and future CSO performance.

5.4. Baseline Conditions

The CSO Master Plan was developed with the 2013 year as the baseline year. The Preliminary Proposal, existing hydraulic models, and other CSO related relevant reports were developed based on this baseline condition.

To ensure a common basis for control system sizing and regulatory compliance that is not affected by the annual variations in precipitation and river levels, the CSO Master Plan adapts the 2013 hydraulic model with the 1992 Representative Year precipitation and river levels as the baseline condition for planning and evaluation of control options.

5.5. Planning Projections

The Master Plan accounts for population growth in the design process. Clause 8 of EA No. 3042 requires no increase in frequency or volume of CSO in the existing system due to new and upgraded land development. Increases in wastewater from growth in population located within a combined sewer district is generally required to be offset with reductions in runoff area.

To demonstrate compliance with the licensing requirements, the City regulates the development process generally by requiring that the post development peak wet weather flows (PWWF) in the combined sewer districts is equal to or less than the pre-development PWWF. As the City continues to regulate the development process and prohibit the use of combined sewers in new developments, it was anticipated that there would be no impact in the combined sewer systems from new development. The CSO Master Plan projections account for an unmitigated increase in sewage flow only in the separate sewer areas.

In 2020, the City started to use the CSO Master Plan to meet Clause 8 for small developments (e.g. single family and two family) by removing additional flows in the combined sewer areas. Strategic CSO mitigation projects from the CSO Master Plan will be used to offset any additional flows that may come from the small scale developments. This approach aligns with the goals of OurWinnipeg and the Complete Communities Direction Strategy by enabling population growth in the intensification target area without costly on-site land drainage management.

The annual report documents the estimated increase in volume of CSOs caused by small scale developments and the estimated decrease in volume as a result of infrastructure development on the overall combined sewer system on an annual basis. This aligns with the requirements detailed in the Provincial letters from July 8, 2021, June 7, 2022 and August 1, 2023.

5.6. CSO Control Technologies

Clause 8 of EA No. 3042 requires the use of green technology and innovative practices in the design and operation of all new and upgraded storm and wastewater infrastructure. Both green and grey infrastructure are considered in the CSO Master Plan design. Green infrastructure (GI) refers to the use of natural hydrologic processes to reduce, store, or attenuate surface runoff from entering the combined or land drainage sewer systems. Many of the GI projects also improve water quality of the surface runoff received. Grey infrastructure refers to the conventional infrastructure projects to address sewer system incapacity, such as pipes and storage tanks.

The control technology selection for each of the combined sewer districts was developed through a two-step approach and selection process. The first step of the review included an evaluation of the applicability of sewer control option for the district. This evaluation was based on a number of criteria, including compatibility with existing sewer infrastructure, proximity to the primary CSO outfall/interceptor sewers, and estimated hydraulic performance. The initial solution configurations were implemented within the model based on system hydraulics. Locations were verified with the City's GIS database with respect to constructability and feasibility.

The second step of the process included the refinement of the initial control option selection to achieve the 85 percent capture target in the most cost-effective manner. These refinements included:

- A review and further evaluation of sewer districts with screening operational challenges
- Incorporation of additional complete or partial sewer separation where cost-effective

- The addition of sewer system control and/or Combined Sewer-Storm Relief Sewer (CS-SRS) interconnection adjustments to accommodate additional latent storage
- Incorporation of additional off-line storage where required to provide the remaining volume capture required to meet Control Option No. 1

Further details to each of these refinements can be found in Section 3.5.4 of CSO Master Plan Part 2.

5.7. Water Quality

As per Clause 15 of EA No. 3042, the City developed an Interim Combined Sewer Overflow Monitoring Plan to aid in the development of the CSO Master Plan. The Interim Plan was a multi-year water quality monitoring program that was conducted to collect and update river and CSO water quality data for the development of the CSO Master Plan. The water quality monitoring data was collected in 2014 and 2015. The event mean concentrations (EMC) of the data collected from the 2014 and 2015 water quality monitoring program are provided in

Table 1. The EMC of ammonia, nitrate, and total phosphorus (TP) were used to determine pollutant loads in the NRPI reports, while TP, total nitrogen (TN), and nutrient loading were used as the baseline for the water quality modeling and loading assessments for evaluation of control option alternatives for the CSO Master Plan. The assessment indicated that the CSO discharge quality varied by location and between events but was within expected ranges for combined sewer discharges, there was very little difference in performance among the control option alternatives.

Table 2 indicates the number of days the bacteria objective may be exceeded for each alternative. The detailed analysis and results of the CSO Master Plan water quality monitoring work are documented in the Preliminary Proposal.

Table 1 - Pollutants EMC from 2014/2015 Water Quality Monitoring Program

Substance Name	Unit	EMC
[1]Ammonia	mg/L N	5.72
[1]Nitrate-N	mg/L N	0.34
[1,2]Total Phosphorus	mg/L P	2.71
[2]Total Nitrogen	mg/L N	15.25

1 – Parameters used in the NPRI reports
2 –Parameters used in the CSO Master Plan nutrient loading assessments

Table 2 - Potential Plans Bacteria Metrics (CH2MHill et al., 2015)

Plan Alternative	Control Limit	Number of Exceedances (days/year)
-	Baseline	44
1	85% Capture in a representative year	44
2	Four Overflows in a representative year	41
3	Zero Overflows in a representative year	35
4	No More Than Four Overflows per year	39
5	Complete Sewer Separation	42

As per the CSO Master Plan approval letter, the City will be implementing Control Option No. 1 while further evaluating the bacteriological water quality improvement identified for Control Option No. 2. A water quality report will be submitted once every 5 years, starting on December 31, 2024.

The City presented a proposed water quality monitoring plan to meet the 2024 requirements which was accepted by the Province in January 2023. See the accepted Water Quality Monitoring Plan.

The implications of maintaining a percent capture program on water quality will be evaluated and will be provided in the 2030 Master Plan update submission.

5.8. Climate Change

Climate change considerations were accounted for in the planning and development of the CSO Master Plan. As documented in the CSO Master Plan Preliminary Proposal, historic precipitation information (1960 to 2012) was reviewed to understand precipitation trends and the impact climate change may have on the precipitation trends over time.

Precipitation trends indicate that climate change is linked to less frequent but larger rainfall events. Winnipeg is expected to experience an increase in the frequency of small rainfall events but a consistent trend for larger events. Since the smaller events can be captured in the CSO control system, it is expected that the trend would not be detrimental to the CSO program performance. However, there is a high degree of uncertainty in long-term trends if the frequency of large events increases.

GI has been identified as an opportunity to improve CSO performance levels and provide resiliency to the potential future impacts of climate change. The City will continue to undertake GI pilot projects to evaluate their benefits and long-term performance for future application. An allowance of 10 percent of the total CSO Master Plan capital cost estimates has been included for future GI implementation and to achieve regulatory compliance for Clause 8 of EA No. 3042.

Furthermore, prioritizing sewer separation work will provide the program with climate change resiliency. Any additional runoff generated from climate change impacts on precipitation trends will continue to be directed to the land drainage sewers for the districts which have been separated.

The City will continue to monitor and track weather patterns to assess any impact to the CSO Master Plan and the use of 1992 as the representative year to represent the long-term typical conditions in the City of Winnipeg.

5.9. Communications

Maintaining an open engagement with stakeholders is essential to the success of the CSO Master Plan. The City will continue to engage with public and the Provincial regulator on progress of the CSO Master Plan execution.

5.9.1. Public Engagement

The City established a public engagement program to inform, engage, and consult the public on the CSO Master Plan in the first stage of the Master Plan. The public engagement program included multiple public consultation events for the public to provide input. In addition to public consultation events, a Stakeholder Advisory Committee (SAC) was established to provide advice and direction on the study phase.

The general public was engaged through various public presentations and workshops, internet-based tools, including a blog open for public comments, an email Q&A option, a CSO educational video, and media interviews. The information gathered from the public engagement was evaluated and integrated into the Preliminary Proposal.

Upon submission of the Preliminary Proposal, the City continued to inform and educate the public on the development of the Master Plan using the internet-based tools. The City optimized the public webpage dedicated to the CSO Master Plan work by restructuring and updating it to allow more content and the most up-to-date information be made available to the public. The updated website also allows the public to access the information and navigate the website in a more effective and user-friendly manner. A screen capture of the updated City public webpage can be found in Figure 3.

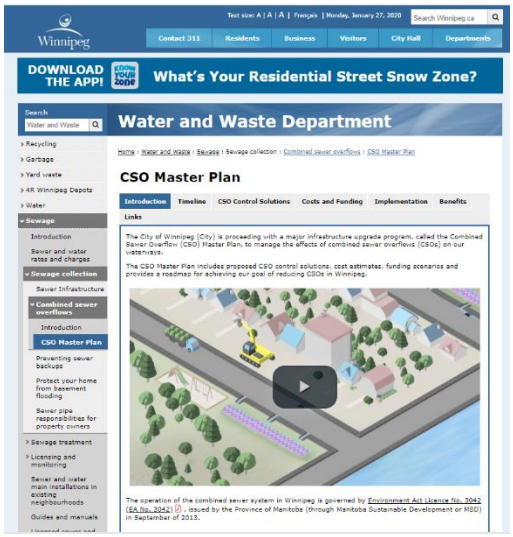

Figure 3 - Screen Capture of the City Webpage

5.9.2. Public Education

The City website contains important information relating to the CSO Master Plan. The website serves as a public education tool to provide Winnipeg residents information on the Master Plan and its benefits. Animated videos and plain language descriptions illustrate and clearly describe the operation of our complex combined sewer systems. The City website also contains information about CSO relief projects and the annual CSO discharge results.

5.9.3. Public Notification System

The City introduced a public notification system called the Sewer Overflow Information System (SOIS) in 2004 to notify the public on the likelihood of overflows as a result of the recommendation from the 2003 Clean Environment Commission hearings. This system indicated the likelihood of overflows into the Red and Assiniboine Rivers based on readings of high-water sensors in the sewers at various overflow locations along with the City's rivers and other monitoring indicators.

In 2013, the City was requested to develop a plan to accommodate a new, enhanced public notification system that would provide a near real-time indication of CSO notifications with overflow occurrences and duration by December 31, 2015 to comply with Clause 10 of EA No. 3042. The CSO Public Notification System Plan, describing the development and implementation plan of the enhanced public notification system, was submitted to the Province on December 15, 2015, and was later approved.

The enhanced public notification system was in the development phase between 2017 and 2021 to test it for reliability and accuracy of the CSO notification predictions. It is linked to the most current hydraulic model for the City of Winnipeg CS system, along with rainfall and outfall instrumentation data at each of the 46 of the 76 combined sewer outfalls. The City engaged with the Province in May 2022 and launched the enhanced public notification system in July 2022. The City of Winnipeg CSO Public Notification Tool notifies the public when a CSO is occurring and estimates its duration in near real-time. Further information related to the tool is available on the City of Winnipeg website:

https://legacy.winnipeg.ca/waterandwaste/sewage/csoNotification.stm.

5.10. Regulatory Engagement

The City worked closely with the Province to develop the CSO Master Plan. During the development phase of the Master Plan, the City met with two different regulatory groups, a regulatory liaison (management) group and a regulatory working group to raise challenges, report on project progress updates, and to promote collaboration with the regulator to ensure successful program delivery.

5.11. District Engineering Plans

The District Engineering Plans (DEPs) were developed to provide conceptual solutions for the Control Option No. 1 performance target (85 percent capture in a representative year) for each of the 43 combined sewer districts.

The DEPs are ongoing, live documents. Each of the districts will undergo preliminary and detailed levels of design based on the solutions recommended in the DEPs, and will be updated throughout the implementation phase as required. The current version of the DEPs can be found in the CSO Master Plan Part 3B.

6. Capital Cost Summary

A conceptual level Class 5 estimate was developed for the CSO Master Plan. A Class 5 estimate is defined by the *American Association of Cost Engineers International,* (AACE) *Cost Estimate Classification System - As Applied in Engineering, Procurement, and Construction for the Process Industries* (AACE, 1997) as having a project definition of zero to two percent to be used in a conceptual study with an expected range of accuracy from -50 percent to +100 percent.

The total capital cost to implement the CSO Master Plan including the 10 percent GI allowance is estimated as $1,150,400,000 in 2019 dollars. Applying the maximum +100 percent of the Class 5 estimating range, the total capital cost for budgeting purposes is estimated to be $2,300,800,000. The capital cost summary is shown in Table 3.

Table 3 - CSO Master Plan Capital Cost Estimate (2019 dollars)

Item	2019 Capital Cost Estimate
Class 5 Estimated Capital Costs	$1,045,800,000
Green Infrastructure Allowance (10%)	$104,600,000
Subtotal – Capital Cost Estimate	**$1,150,400,000**
Class 5 Estimate Range of Accuracy: -50% to +100%	$575,200,000 to $2,300,800,000
Total Capital Cost for Budgeting Purposes	**$2,300,800,000**

7. Funding Scenarios

The current City funding method for the CSO Master Plan is through the Sewer Utility. The sewer rates have been steadily rising to cover the inflation rate and the costs required for assorted water and wastewater infrastructure upgrades. However, to meet the mandated timeframe in EA No. 3042, an aggressive increase in sewer rates is required and this amount was determined to be unaffordable by utility rate payers. An affordability assessment documented in the Preliminary Proposal suggested that the Master Plan would not be able to meet the licencing requirements based on the current and forecast utility rates without additional external funding support.

Based on the recommendation from the CEC for sharing the cost equally between the Municipal/Provincial/Federal governments, the CSO Master Plan was developed with the following three funding scenarios.

- Scenario 1 – Tri-level funding agreement between the Government of Canada, Manitoba Government, and the City of Winnipeg with each contributing $30 million per year each (a total capital budget of $90 million dollars per year)
- Scenario 2 – Bi-level funding agreement between the City of Winnipeg and either the Manitoba Government or the Government of Canada with each contributing $30 million per year each (a total capital budget of $60 million dollars per year
- Scenario 3 – City-only funding with a total estimated capital budget of $30 million per year

The funding scenario is based on the following assumptions:

- Three percent inflation per year for annual funding and construction costs,
- A four-year initialization period at beginning of program, which includes a two-year allowance for alterations of EA No. 3042 and a two-year allowance for securing Federal and Provincial funding commitments, and

- Consistent funding arrangements established throughout the entire implementation period.

The 2019 CSO Master Plan described the funding impacts in detail. The summary of the impact of the three funding scenarios are provided in Table 4.

Table 4 - CSO Master Plan Funding Scenario Evaluation Results [2019 Dollars] (Jacobs, 2019)

Program Scenario	Description	Funding by	Annual Budget	Timeline
Scenario 1	3 Levels of Funding 3 x $30 Million	Tri-level: Government of Canada, Manitoba Government, and the City of Winnipeg	$90 Million	27 years (2047)
Scenario 2	2 Levels of Funding 2 x $30 Million	Bi-Level: City of Winnipeg and either the Manitoba Government or the Government of Canada	$60 Million	39 years (2059)
Scenario 3	City Only $30 Million	One Level: City of Winnipeg Only	$30 Million	75 years (2095)

The City requires funding from the Federal and Provincial governments to meet the 2045 Provincial deadline due to the scale of the work required as per the intent of the 2003 CEC recommendations. However, any changes to inflation rates or delay to annual funding approvals to the request will result in overall project cost increases and a longer implementation timeline.

The CSO Master Plan originally stated that if no additional funding was provided by the Provincial and Federal Governments by 2023 or earlier, the CSO Master Plan would move to the Program Scenario 3 which is based on City only funding and has a longer implementation timeline. The City is currently reviewing the resource needs to meet the target capture for the 2045 Provincial deadline.

The Program Scenario 1 Capital Budget with three percent annual inflation can be seen in see Figure 4 below.

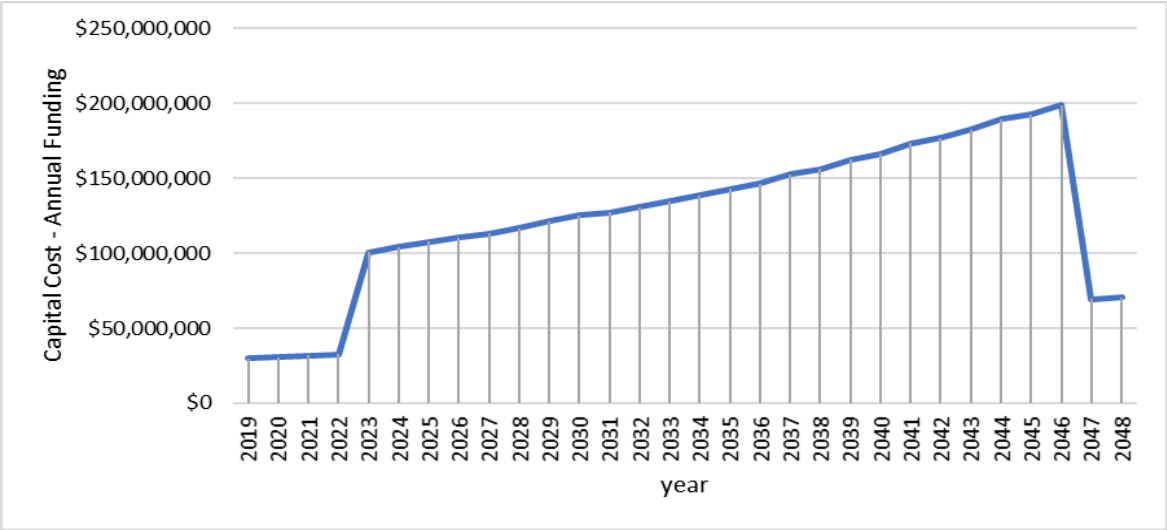

Figure 4 - CSO Master Plan Program Scenario 1 Capital Budget Inflated at Three Percent Annually

8. Design Development of Proposed Projects

The CSO Master Plan and the DEPs were developed to a conceptual level of detail. The individual project selections and designs are based on the hydraulic model evaluations and high-level assessments of constructability. It is expected that the proposed projects identified will change and adapt as further information is collected during the program implementation and individual project design studies. This process is illustrated in Figure 5.

Figure 5 - Key Design Stages in Life of a CSO Project

The City plans to complete a number of additional evaluations based on the details presented in the DEPs to form the basis for further design and construction within each of the sewer districts. Each of the proposed projects will undergo a preliminary and detailed design stage to confirm their constructability. A potential approach to the design process would be for several neighboring sewer districts to the district in question under design to be further refined as a package during the preliminary design phase. Additional detail would be collected and evaluated to fully understand the existing sewer system surrounding each specific district prioritized, and confirm selection of the optimal CSO control technology. This would be followed by detailed design where the parameters of the control technology would be finalized for construction.

Each of the combined sewer districts with the solutions constructed will be monitored to determine the level of performance achieved. This information will be input into the current hydraulic model and applied as part of future design evaluations. CSO volume monitoring and operation and maintenance of sewer systems will continue for the life of the infrastructure.

9. Program Implementation Strategy

In addition to the program criteria, an implementation strategy has been defined in the CSO Master Plan documentation to balance resources, risks, and costs of the projects. Additionally, projects were scheduled based on the funding scenario.

Sewer separation work is an ongoing priority for the program implementation due to the high benefits and low risks. As cost escalation can have significant impacts to the cost of long-term programs, completing more expensive work upfront can reduce the relative impact of cost escalation. Sewer separation reduces basement flooding risk and reduces wet weather runoff to the combined sewer system. It addresses the required CSO reduction targets, while also improving the basement flooding level of service for the area.

There are a number of additional opportunities which require further investigation as part of program implementation, such as GI solutions and floatable management.

GI was assessed separately from the other control options. It was not been included in the base solutions because of unknowns and uncertainty with its application. Each district will require a detailed assessment on potential GI locations and will require the development of policies and design standards with engagement and buy-in from residential, commercial, and industrial customers to optimize opportunities. The analysis of the main technology evaluations and pilot studies are scheduled to be completed within the first ten years. This will provide confirmation that these proposed options are appropriate and suitable for the Winnipeg sewerage system. GI and sustainable solutions should be reviewed as part of every sewer infrastructure project to comply with Clause 8 of EA No. 3042. GI projects will provide the necessary performance improvements to meet CSO volume capture targets and will assist with mitigating detrimental impacts from climate change. An allowance of 10 percent of the total CSO Master Plan capital cost estimates has been included for future implementation of GI solutions.

The floatables management approach in the CSO Master Plan is based on outfall screening. Screening is not the most effective approach for many of our sewer districts due to many factors including; the surrounding environment and the

sewer system hydraulics. Floatables management is required for outfalls in which combined sewage is discharged. For districts in which complete sewer separation is to be completed, combined sewage will no longer be discharged from the outfalls in these districts and floatable management will not be required.

The City has identified an alternative approach to screening to address the floatable management requirements, which is similar to a successful program run by the City of Ottawa. This proposed new approach targets source control as a potential alternative to screening. This is expected to achieve similar or better results while eliminating end-of-pipe screening. The alternative floatables management plan provides a significant opportunity to achieve the intended results, while avoiding the high capital and long-term operations and maintenance (O&M) costs of screening facilities.

Additional sewer storage and mechanical controls solutions are scheduled to follow sewer separation work. In order to appropriately size and operate this type of infrastructure, sewer network, power, communications, monitoring, and operational infrastructure need to be in place to allow for a detailed understanding of network performance.

10. Schedule

The schedule is based on funding and the evaluation of the scope of work involved with each of the districts, CSO volume detriment, cost-benefits analysis, and district prioritization. See Appendix E for the District Program Scenario 1 implementation schedule and Figure 6 for the high-level schedule which shows for the implementation strategy more clearly. Further details on the implementation can be found in the Master Plan (section 7) and within the annual report for updated information.

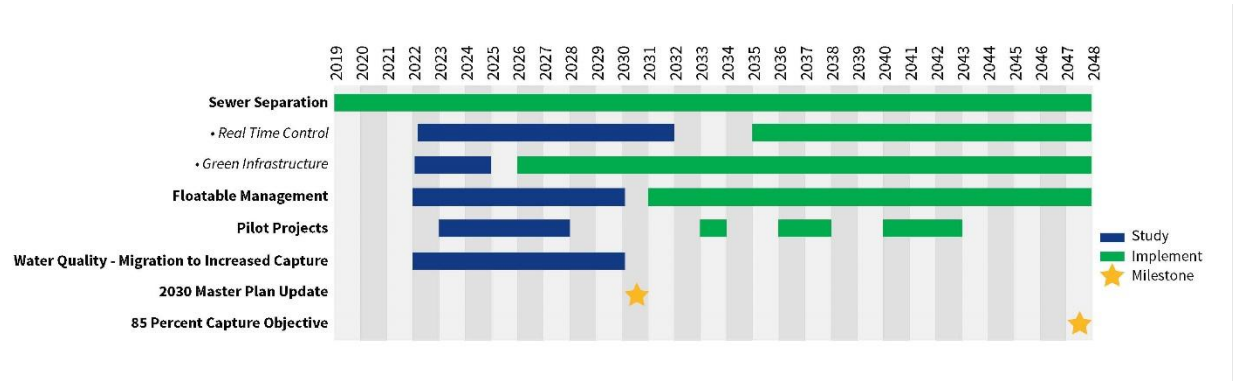

Figure 6 - CSO Master Plan Program Scenario 1 Overview Schedule

11. Capital Projects Overview

To achieve 85 percent CSO volume capture in a Representative Year, sewer separation work is a major component and is proposed for 15 districts. A breakdown of the cost for each control technology applied in the CSO Master Plan is shown on Figure 7.

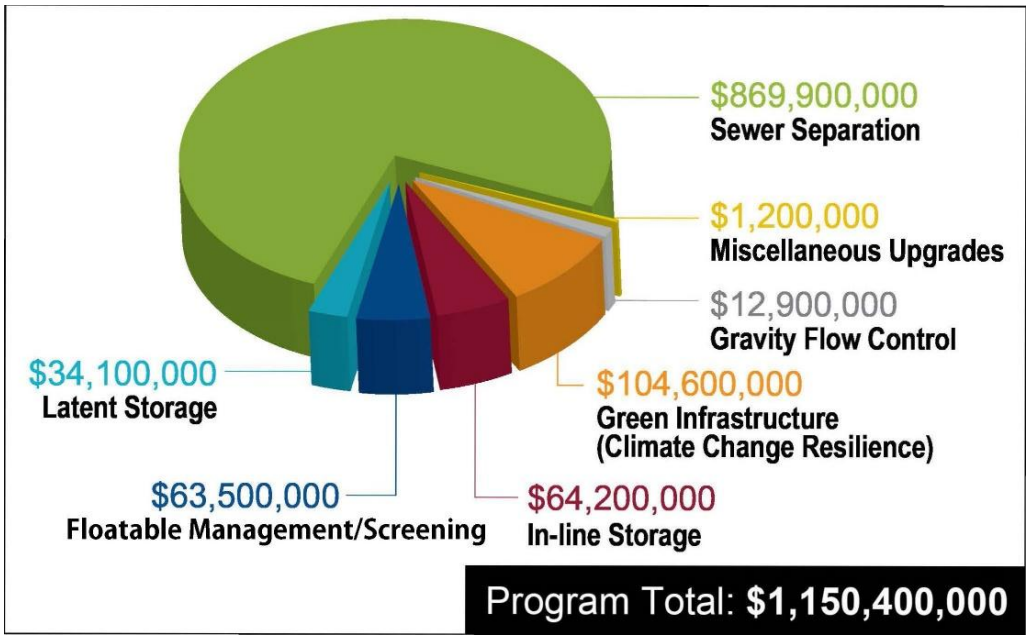

Figure 7 - CSO Master Plan Capital Cost Summary (2019 Dollars)

Figure 8 provides an overview map of the location of the proposed control options for each district.

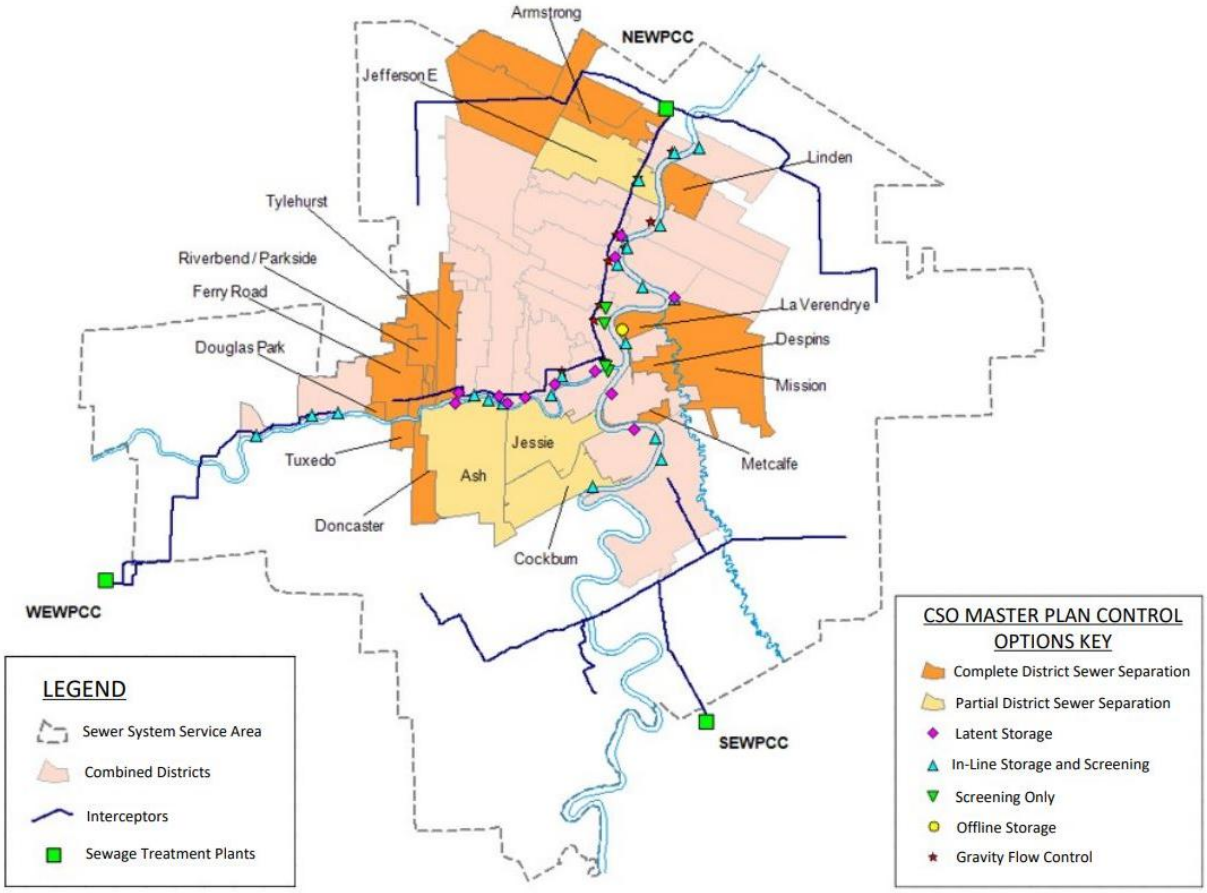

Figure 8 - CSO Master Plan Project Overview Map

12. Risks and Opportunities

This section provides an overview of the risks and opportunities identified in the development of the Master Plan.

12.1. Risks

Program Implementation

Factors that may pose a risk to the program implementation are as follows:

- Funding – There is a risk that funding from other levels of government will not be available over the life of the CSO Master Plan. The City will continue its work with the available allocated annual budget.
- Technology – There is a risk that implementation of the green and innovative technologies as per Clause 8 of EA No. 3042 may not perform as expected. Technologies that are proven to be successful in other jurisdictions may not apply the same to Winnipeg due to the environment. The City will undertake research and seek experience and knowledge from other jurisdictions on the technologies prior to implementation.
- Resource – Market fluctuation and insufficient local resources may pose a risk to a cost increase and a delay in the implementation schedule.
- Schedule – There are many sources of risk associated with the planning and execution of the program. Such risks include funding shortages or high bid costs, limitation of engineering and construction service capacity, and extended project approvals.
- Migration to Control Option No. 2 – The change in performance target (from Control Option No. 1 to Control Option No. 2) would increase costs and likely increase the timeline of the Master Plan due to the increase level of effort required for the increased CSO volume reduction.

Climate Change

An increase in extreme weather events is a potential risk to the performance of the CSO Master Plan program. The program is based on a 1992 Representative Year. Long-term monitoring of rainfall trends will continue during the execution of the Master Plan to monitor any trends.

Basement Flooding

Modification and upgrade of existing infrastructure may pose a risk to basement flooding due to potential system operation issues.

Program Feasibility and Sustainability

Factors to be considered regarding the feasibility and sustainability of the program include: affordability, public impact, City resources, construction capacity, services overlap, and control option re-evaluation.

Affordability: The City's finances its capital and operating budgets for the sewer utility on a user-pay basis through sewer rates. To ensure that the rates are affordable to rate payers, the City takes a longer-term view of rates. The rates have steadily been rising for several years and are expected to continue to rise due to wastewater treatment plant upgrade works and replacement and refurbishment of aging infrastructure.

Public Impact: Sewer separation projects are planned throughout the combined sewer system and will encompass large sections of the sewer districts. Each of these will include large programs that will each take several years to complete. This may pose an impact on both the residents and businesses.

City Resources: City resources will need to increase to achieve the new requirements and implement all components of the CSO Master Plan.

Construction Capacity: With the additional construction projects demand, there is a risk that Winnipeg may not be equipped with sufficient local construction industries to undertake the work, posing a potential risk of a schedule delay.

Services Overlap: There are multiple competing infrastructure needs within the City to consider as well as the possibility of additional requirements in the future that cannot be forecast. Coordination with other City services will be required to minimize impacts and identify planning overlaps.

Control Option re-evaluation: As technologies evolve over time, there is a risk that the selected control option may need to be re-evaluated to validate the best control option available. This implies that there is a possibility of rejection, which may lead to the need for more costly substitutes.

District Engineering Plan Risks

The District Engineering Plan is comprised of individual conceptual solutions to CSO mitigation for each of the combined sewer districts. Each of the risks and opportunities applicable to the control solutions recommended within each sewer district to meet Control Option No. 1 are documented in the Part 3B – District Engineering Plans of the CSO Master Plan.

Any changes to the control solution could cascade to a reevaluation of risks associated with each of the specific projects.

12.2. Opportunities

A number of opportunities to improve the volume percent capture during the program were identified during the development of the CSO Master Plan. The following section describes the main areas that the City could benefit from during the development of the Master Plan.

Green Infrastructure

Clause 8 of EA No. 3042 requires the use of green technology in the design and operation of all new and upgraded infrastructures. In the CSO Master Plan, each of the combined sewer district control solutions contains a GI component. GI technologies will be evaluated to promote additional CSO volume storage and sustainability. A budget of 10 percent of the capital program is included in the CSO Master Plan budget for the implementation of the GI technology. An example of a GI study conducted by the City is the North East Exchange District Engineering Study.

North East Exchange District Engineering Study

The City undertook a pilot study in 2017 using a soil retention green technology, Strata cells, for the reconstruction of the John Hirsh Place in the North East Exchange District. Past studies have demonstrated that Strata cells promote tree growth and reduce loading on combined sewers.

To demonstrate tangible benefits from the study, the City undertook flow monitoring prior to construction and completed post-construction flow monitoring in 2022 to evaluate performance.

The 2022 flow monitoring data showed a delay in runoff response from the catchment aligned with expected performance. Future monitoring will be undertaken to understand how the solution performs.

Floatable Management

Clause 12 of EA No. 3042 requires the Master Plan to demonstrate the prevention of floatable materials in CSO effluent. The Master Plan proposed investigating the use of both screening and the alternative floatable management approach to prevent floatable materials from entering the river.

Real Time Control

Real time control (RTC) provides a method of increasing system performance by improving the operation of the system. With Winnipeg's flat topography and large diameter pipe network, application of RTC becomes very valuable as it can adapt and balance the system for real precipitation events that are spatially and temporally distributed. The incorporation of RTC and monitoring instrumentation will provide an increased understanding of operation and a better control on a real time basis, and an optimization of flows in the system and to the treatment plants.

Stakeholder Collaboration

Working together with other stakeholders including industry groups and the public will provide partnership opportunities that may provide additional benefit to the CSO Master Plan. Furthermore, this will provide an opportunity to further engage, communicate, and educate the community on the ongoing work with the program.

Further details associated with both the risks and opportunities of the program can be found in the CSO Master Plan.

13. Other Initiatives

Undertaking major sewer infrastructure upgrades in an interconnected sewer network is complex as changes in flow and capacity of one area of the system impacts other areas. During the execution of the CSO Master Plan, it is important to consider all ongoing initiatives. The following section describes the ongoing initiatives that are considered while delivering the CSO Master Plan.

13.1. OurWinnipeg

The OurWinnipeg 2045 Development Plan is the City's 25-year development plan that provides the vision, goals, and policies to increase the quality of life for all residents. It guides growth and change for the City to accommodate future residential growth in a sustainable manner. To support the successful delivery of the vision, Complete Communities 2.0 was developed.

The Complete Communities 2.0 is a direction strategy of OurWinnipeg. It is a city-wide secondary plan that guides growth, development, and land use in Winnipeg. With the population increase, the treatment and conveyance demand are also expected to increase. There is a demand for more capacity to service future population growth. The CSO Master Plan incorporates a 35-year design horizon into the design and planning of sewer infrastructure. It uses the City's Planning and Land Use Model (PLUM) forecast data to account for future development and population growth.

13.2. Pollution Prevention Plan and Sewer By-Law

The City has a Pollution Prevention Program to protect the sewage collection and treatment system, our rivers and lakes, and the environment. This is a process that shifts the focus from municipal wastewater treatment to the control of pollutants at the source by:

- Avoiding the use of pollutants wherever possible
- Reducing the amount of pollutants that reach the wastewater system, if avoiding is not possible
- Eliminating pollutants wherever possible by replacing products with more environmentally friendly products

Businesses that are a part of the Pollution Prevention Program are required to submit a Pollution Prevention (P2) Plan outlining the source of the pollutants and measures to prevent, eliminate, or reduce the discharge of those pollutions to the wastewater and/or land drainage system. The City will perform inspections, collect samples, provide reviews, and approvals of the P2 Plans to ensure proper measures are in place to protect the environment.

The purpose of the City of Winnipeg Sewer By-Law is to protect public safety, the environment, and the City infrastructure by setting and regulating sewage discharge limits into the sewer systems and natural water courses.

For further information, refer to the following webpages:

- Winnipeg Pollution Prevention Plan webpage:

  http://www.winnipeg.ca/waterandwaste/sewage/pollutionPrevention/default.stm

- Winnipeg Sewer By-Law webpage:

  https://winnipeg.ca/waterandwaste/sewage/projects/sewerBy-law/default.stm#tab-background

14. References

AACE International. 1997. *Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries*. AACE International Recommended Practice No. 18R-97. (pg. 3-46).

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Jacobs Engineering Group. 2019. *CSO Master Plan.* Prepared for: City of Winnipeg, Water and Waste Department. Winnipeg, Manitoba. August 2019.

Manitoba Conservation and Water Stewardship (MCWS). 2013. *Environment Act Licence No. 3042.* Client File No.: 3205.00. September 4, 2013.

Wardrop Engineering Inc. (Wardrop), TetrES Consultants Inc., CH2M Hill Canada and EM Services Inc. 2002. *Combined Sewer Overflow Management Study* (2002 CSO Study). Final Report. Prepared for: City of Winnipeg, Water and Waste Department. November 2002.

Appendix A – Environmental Licence No. 3042

THE ENVIRONMENT ACT
LOI SUR L'ENVIRONNEMENT

LICENCE

Manitoba

Licence No. / Licence n° **3042**

Issue Date / Date de délivrance **September 4, 2013**

In accordance with *The Environment Act* (C.C.S.M. c. E125) /
Conformément à *la Loi sur l'environnement* (C.P.L.M. c. E125)

Pursuant to Section 11 / Conformément au Paragraphe 11

THIS LICENCE IS ISSUED TO: / CETTE LICENCE EST DONNÉE À :

CITY OF WINNIPEG;
"the Licencee"

for the operation of the Development being the combined sewers and overflow structures located within the City of Winnipeg with discharge of wastewater into the Assiniboine River and Red River and associated tributaries, and subject to the following specifications, limits, terms and conditions:

DEFINITIONS

In this Licence,

"accredited laboratory" means an analytical facility accredited by the Standard Council of Canada (SCC), or accredited by another accrediting agency recognized by Manitoba Conservation to be equivalent to the SCC, or be able to demonstrate, upon request, that it has the quality assurance/quality control (QA/QC) procedures in place equivalent to accreditation based on the international standard ISO/IEC 17025, or otherwise approved by the Director;

"approved" means approved by the Director in writing;

"average dry weather flow" means the average daily volume of wastewater entering the combined sewer system in dry weather;

"combined sewer system" means a wastewater collection system which conveys wastewaters (domestic, commercial and industrial wastewaters) and stormwater runoff through a single-pipe system to a sewage treatment plant or treatment works;

"combined sewer overflow (CSO)" means a discharge to the environment from a combined sewer system;

"Director" means an employee so designated pursuant to *The Environment Act*;

"effluent" means treated wastewater flowing or pumped out of the combined sewer system;

"enhanced primary treatment" means wastewater treatment that utilizes a chemical coagulant/flocculant to remove suspended matter and soluble organic matter;

"Environment Officer" means an employee so appointed pursuant to *The Environment Act*;

"Escherichia coli (E. coli) " means the species of bacteria in the fecal coliform group found in large numbers in the gastrointestinal tract and feces of warm-blooded animals and man, whose presence is considered indicative of fresh fecal contamination, and is used as an indicator organism for the presence of less easily detected pathogenic bacteria;

"fecal coliform" means aerobic and facultative, Gram-negative, nonspore-forming, rod-shaped bacteria capable of growth at 44.5° C, and associated with fecal matter of warm-blooded animals;

"five-day biochemical oxygen demand (BOD_5)" means that part of the oxygen demand usually associated with biochemical oxidation of organic matter within five days at a temperature of 20° C;

"floatable material" means items such as, but not limited to, plastics and other floating debris (e.g., oil, grease, toilet paper, and sanitary items);

"grab sample" means a quantity of wastewater taken at a given place and time;

"MPN Index" means the most probable number of coliform organisms in a given volume of wastewater which, in accordance with statistical theory, would yield the observed test result with the greatest frequency;

"overflow event" means an event that occurs when there is one or more CSOs from a combined sewer system, resulting from a precipitation event. An intervening time of 24 hours or greater separating a CSO from the last prior CSO at the same location is considered to separate one overflow event from another;

"overflow point" means a point of a wastewater collection system via which wastewater may be deposited in water or a place and beyond which its owner or operator no longer exercises control over the quality of wastewater;

"percent capture" means the volume of wet weather flow treated in comparison to the volume of wet weather flow collected on a percentage basis;

"real time" means the actual time at which an event occurs;

"sewershed" means the area drained by a particular network of sewers;

"Standard Methods for the Examination of Water and Wastewater" means the most recent edition of Standard Methods for the Examination of Water and Wastewater, published jointly by the American Public Health Association, the American Waterworks Association and the Water Environment Association;

"wastewater" means the spent or used water from domestic, industrial and commercial sources that contains dissolved and suspended matter;

"wastewater collection system" means the sewer and pumping system used for the collection and conveyance of domestic, commercial and industrial wastewater;

"wet weather flow" means the combined flow resulting from:

i) wastewater;
ii) infiltration and inflows from foundation drains or other drains resulting from rainfall or snowmelt; and
iii) stormwater runoff generated by either rainfall or snowmelt that enters the combined sewer system; and

"wet weather period" means the spring thaw period and any period of precipitation capable of generating inflow to a combined sewer system that exceeds the capability of the system to convey wet weather flows to a sewage treatment plant.

GENERAL TERMS AND CONDITIONS

This Section of the Licence contains requirements intended to provide guidance to the Licencee in implementing practices to ensure that the environment is maintained in such a manner as to sustain a high quality of life, including social and economic development, recreation and leisure for present and future Manitobans.

Compliance with Licence

1. The Licencee shall direct all wastewater generated within the City of Winnipeg to sewage treatment plants operating under the authority of an Environment Act Licence or discharge wastewater to receiving waters in accordance with this Licence.

Future Sampling

2. In addition to any of the limits, terms and conditions specified in this Licence, the Licencee shall, upon the request of the Director:

a) sample, monitor, analyze and/or investigate specific areas of concern regarding any segment, component or aspect of pollutant storage, containment, treatment, handling, disposal or emission systems, for such pollutants or ambient quality, aquatic toxicity, leachate characteristics and discharge or emission rates, for such duration and at such frequencies as may be specified;
b) determine the environmental impact associated with the release of any pollutant(s) from the Development; or
c) provide the Director, within such time as may be specified, with such reports, drawings, specifications, analytical data, descriptions of sampling and analytical procedures being used, bioassay data, flow rate measurements and such other information as may from time to time be requested.

Sampling Methods

3. The Licencee shall, unless otherwise specified in this Licence:
a) carry out all preservations and analyses on liquid samples in accordance with the methods prescribed in "Standard Methods for the Examination of Water and Wastewater" or in accordance with an equivalent analytical methodology approved by the Director;
b) have all analytical determinations undertaken by an accredited laboratory; and
c) report the results to the Director, in writing or in a format acceptable to the Director, within 60 days of the samples being taken, or within another timeframe acceptable to the Director.

Equipment Breakdown

4. The Licencee shall, in the case of physical or mechanical equipment breakdown or process upset where such breakdown or process upset results or may result in the release of a pollutant in an amount or concentration, or at a level or rate of release, that causes or may cause a significant adverse effect, immediately report the event by calling 204-944-4888 (toll-free 1-855-944-4888). The report shall indicate the nature of the event, the time and estimated duration of the event and the reason for the event.

5. The Licencee shall, following the reporting of an event pursuant to Clause 4,
a) identify the repairs required to the mechanical equipment;
b) undertake all repairs to minimize unauthorized discharges of a pollutant;
c) complete the repairs in accordance with any written instructions of the Director; and
d) submit a report to the Director about the causes of breakdown and measures taken, within one week of the repairs being done.

Reporting Format

6. The Licencee shall submit all information required to be provided to the Director under this Licence, in writing, in such form (including number of copies), and of such content

as may be required by the Director, and each submission shall be clearly labeled with the Licence Number and Client File Number associated with this Licence.

SPECIFICATIONS, LIMITS, TERMS AND CONDITIONS

Avoid CSOs

7. The Licencee shall operate the combined sewer system and wastewater collection system such that there are no combined sewer overflows except during wet weather periods.

New or Upgraded Developments

8. The Licencee shall not increase the frequency or volume of combined sewer overflows in any sewershed due to new and upgraded land development activities and shall use green technology and innovative practices in the design and operation of all new and upgraded storm and wastewater infrastructures.

Public Education Plan

9. The Licencee shall, on or before December 31, 2013, submit to the Director, a public education program plan documenting how information on combined sewer overflows will be made available to the public.

Public Notification System

10. The Licencee shall, on or before December 31, 2015, submit to the Director for approval, a plan regarding the development and implementation of an internet-based public notification system for all discharges from combined sewer overflow points, including an assessment of making this notification available on a real time basis.

CSO Master Plan

11. The Licencee shall, on or before December 31, 2015, submit a preliminary proposal for approval by the Director, pursuant to Section 14(3) of *The Environment Act*, for the combined sewer overflow system.

    The plan proposed above would consist of an evaluation of a minimum of the following CSO control alternatives:

    - A maximum of four overflow events per year;
    - zero combined sewer overflows; and
    - a minimum of 85 percent capture of wet weather flow from the combined sewer system and the reduction of combined sewer overflows to a maximum of four overflow events per year.

The Licencee shall, on or before December 31, 2017, file a final Master Plan, including the detailed engineering plans, proposed monitoring plan, and implementation schedule for the approved design identified in the preliminary plan above. The Master Plan is to be filed for approval by the Director. The Licencee shall implement the plan by December 31, 2030, unless otherwise approved by the Director.

Effluent Quality Limits

12. The Licencee shall demonstrate, in the Master Plan submitted pursuant to Clause 11, the prevention of floatable materials, and that the quality of the CSO effluent will be equivalent to that specified for primary treatment to 85% or more of the wastewater collected in the CSO system during wet weather periods. The following effluent quality limits summarize what is expected from primary treatment:
    a) five day biochemical oxygen demand (BOD5) not to exceed 50 mg/l;
    b) total suspended solids not to exceed 50 mg/l;
    c) total phosphorus not to exceed 1 mg/l; and
    d) E. coli not to exceed 1000 per 100 ml.

Annual Progress Reporting

13. The Licencee shall, upon approval of the Master Plan submitted pursuant to Clause 11 of this Licence, implement the plan such that progress towards meeting the required level of treatment is demonstrated annually by submission of an annual report, due March 31 of each year for the preceding calendar year. Annual submissions shall include the progress made on the plan pursuant to Clause 11 including monitoring results and the work plan for the subsequent calendar year.

MONITORING AND REPORTING

Reporting

14. The Licencee shall, prior to December 31, 2013, develop a notification plan acceptable to the Director for each overflow event.

Interim Monitoring

15. The Licencee shall by January 31, 2014 submit a plan to the Director for approval of an interim combined sewer overflow monitoring program for implementation between May 1, 2014 and the date upon which the final master plan is approved by the Director. The plan shall identify locations to be sampled, rationale for these locations, and sampling frequency. The plan also shall identify constituents to be monitored including, but not limited to:
    a) organic content as indicated by the five-day biochemical oxygen demand (BOD_5) and expressed as milligrams per litre;

b) total suspended solids as expressed as milligrams per litre;
c) total phosphorus content as expressed as milligrams per litre;
d) total nitrogen content as expressed as milligrams per litre;
e) total ammonia content as expressed as milligrams per liter;
f) pH; and
g) *E*.coli content as indicated by the MPN index and expressed as MPN per 100 millilitres of sample.

Record Keeping

16. The Licencee shall:
    a) during each year maintain records of:
        i) grab sample dates and locations;
        ii) summaries of laboratory analytical results of the grab samples; and
        iii) combined sewer overflow dates;
    b) make the records being maintained pursuant to sub-Clause 16 a) of this Licence available to an Environment Officer upon request and, within three months of the end of each year, post the results on the public notification site required by Clause 10 of this Licence.

REVIEW AND REVOCATION

A. If, in the opinion of the Director, the Licencee has exceeded or is exceeding or has or is failing to meet the specifications, limits, terms, or conditions set out in this Licence, the Director may, temporarily or permanently, revoke this Licence.

B. If, in the opinion of the Director, new evidence warrants a change in the specifications, limits, terms or conditions of this Licence, the Director may require the filing of a new proposal pursuant to Section 11 of *The Environment Act*.

"original signed by"

Tracey Braun, M.Sc.
Director
Environment Act

Client File No.: 3205.00

Appendix B – 2019 CSO Master Plan Provincial Approval Letter

Manitoba
Conservation and Climate
Environmental Stewardship Division
Environmental Approvals Branch
1007 Century Street, Winnipeg Manitoba R3H 0W4
T 204 945-8321 **F** 204-945-5229
www.gov.mb.ca/sd/

File No. 3205.10
Environment Act Licence No. 3042

November 13, 2019

Chris Carroll, P.Eng., MBA
Manager of Wastewater Services Division
110-1199 Pacific Avenue
Winnipeg Manitoba R3E 3S8
Email: ccarroll@winnipeg.ca

Dear Chris Carroll:

Thank you for your submission of the Combined Sewer Overflow (CSO) Master Plan dated August 28, 2019 that sets out the roadmap for implementing a long term program in order to meet the control target objective of 85 percent capture in the Representative Year as required by Clause 11 of Environment Act Licence No. 3042 (Licence).

The November 24, 2017 approval letter required the City to submit, for approval, a Master Plan including detailed engineering plans, proposed monitoring plans, and an implementation schedule for Control Option No. 1 (i.e., 85% capture in a representative year) as identified in the CSO Master Plan Preliminary Proposal on or before August 31, 2019 and for Control Option No. 2 (i.e., four overflows in a representative year) as identified in the CSO Master Plan Preliminary Proposal on or before April 30, 2030.

Upon review of the CSO Master Plan, I hereby approve the implementation of the CSO Master Plan with the following conditions:

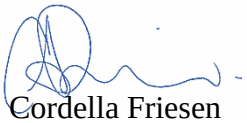
a) The Licencee shall submit for approval an outline of the content of the annual report as required by Clause 13 of the Licence by December 31, 2019;
b) The Licencee shall, prior to submission of the annual report, submit a monitoring plan for approval;
c) The Licencee shall include in the annual report the monitoring report, the proposed planning for the year ahead, and the milestones achieved;
d) The Licencee shall, from the date of issue of this Letter, collect CSO water samples and model river quality data every 5 years to demonstrate improvements in the river water quality due to implementation of Control Option No. 1. The next river water quality report is due December 31, 2024;
e) The Licencee shall carry out an assessment of the impact of climate change to the performance of the CSO program and shall include the assessment report along with the CSO Master Plan for Control Option No. 2 which is due April 30, 2030; and
f) The Licencee shall, on or before April 30, 2025, submit for approval a report demonstrating that the percent capture performance measure, an alternative to Control Option No. 2 as proposed in the CSO Master Plan dated August 28, 2019,

will provide equivalent water quality protection to Control Option No. 2 (i.e., four overflows in a representative year).

The City of Winnipeg shall implement the CSO Master Plan for Control Option No. 1 by December 31, 2045, unless otherwise approved by the Director.

Should you have any questions regarding the foregoing, please contact Asit Dey, Environment Engineer, at (204) 945-2614 or by email at asit.dey@gov.mb.ca.

Yours sincerely,



Cordella Friesen
Director
The Environment Act

c: Duane Griffin/Patrick Coote, City of Winnipeg
Shannon Kohler/Yvonne Hawryliuk/Nada Suresh, Conservation and Climate
Public registries

Appendix C – Clause 8 Provincial Approval Letters

Winnipeg | Water and Waste
Eaux et déchets

April 19, 2020

Client File No.: 3205.00
Our File Nos S-734, S-734(A) EMS
020-17-08-11-00
020-17-08-11-0N

Manitoba Conservation and Climate
Environmental Stewardship Division
Environmental Compliance and Enforcement Branch
1007 Century Street
Winnipeg, MB R3H 0W4

Attention: Yvonne Hawryliuk, MSc - Provincial Manager

RE: ENVIRONMENT ACT LICENCE NO. 3042 CLAUSE 8

This letter is in response to your March 18, 2021 letter requesting the City of Winnipeg (City) provide additional information that demonstrates compliance with Clause 8. Specifically, an estimated volume that small scale developments have increased to the combined sewer system and the estimated volume offset through various technology or infrastructure developments.

The City is providing this information below for the overall combined sewer shed.

It is estimated that a small scale development within a combined sewer district will increase the volume to the combined sewer system by approximately $1m^3$ for a 5 year rainfall event. A review of small scale developments since 2014 in combined sewer districts has been conducted and it has been determined that approximately 2800 have been accepted. From 2014 to 2020, small scale developments have increased the volume to the combined sewer system by approximately $2,800m^3$ for a 5 year rainfall event.

It is estimated that the sewer separation work completed up to 2020 in the Cockburn Calrossie combined sewer district has decreased the volume of land drainage to the combined sewer system by approximately $57,000m^3$ for a 5 year rainfall event.

This information will be submitted on an annual basis starting with the 2021 CSO Annual Report.

Should you have any questions on this please contact Michelle Paetkau at 204-986-4904 or by email at mpaetkau@winnipeg.ca.

Sincerely,

M Paetkau

Michelle Paetkau, P. Eng.
Acting Branch Head for Wastewater Planning and Project Delivery

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109-1199 Pacific Avenue, Winnipeg, Manitoba R3E 3S8
DIVISION DES EAUX USÉES
1199, avenue Pacific, Porte 109, Winnipeg (Manitoba) R3E 3S8

T. | Tél. : 204-986-7550
F. | Fax : 204-986-7193
winnipeg.ca

Tim Shanks, M. Eng., P. Eng.
Acting Manager of Engineering Services Division

MP/dr

c: Siobhan Burland Ross, M. Eng., P. Eng., Manitoba Conservation and Climate (email)
M.L. Geer, CPA, CA, Water and Waste Department (email)
T. Shanks, M. Eng., P. Eng., Water and Waste Department (email)
R. Grosselle, Water and Waste Department (email)
M. Paetkau, Water and Waste Department (email)
C. Carroll, Water and Waste Department (email)

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August 28, 2020

Client File: 3205.00
Licence No: 3042

Michelle Paetkau, P. Eng
Acting Branch Head
Wastewater Planning and Project Delivery
110-1199 Pacific Avenue
Winnipeg MB R3E 3S8
Email: mpaetkau@winnipeg.ca

Dear Michelle Paetkau:

RE: Combined Sewage Overflow (CSO) Environment Act Licence 3042
Application of Clause 8

This letter is in follow up to the meeting of February 27, 2020 between Manitoba Conservation and Climate and the Water and Waste Department, regarding the interpretation and application of Clause 8 of Environment Act Licence 3042.

It was agreed upon at the above meeting that the City of Winnipeg would provide Conservation and Climate with a document outlining the strategies and measures the City of Winnipeg will implement to comply with the requirements of Clause 8, namely that there be no increase in the frequency or volume of combined sewer overflows due to development. Conservation and Climate is yet to receive this document. Please submit to Environmental Compliance and Enforcement by September 30, 2020.

In addition, CC has received concerns from the public about how this clause is being applied in the Glenwood neighbourhood. In order to address the concerns and determine compliance, CC is requiring that the City of Winnipeg demonstrate how Clause 8 is being applied within that sewershed by providing supporting documents by September 11, 2020.

If you have any questions, please contact Julie Froese, Environment Officer, Environmental Compliance and Enforcement Branch at Julie.Froese@gov.mb.ca, or 204-945-7104.

Yours sincerely,

Yvonne Hawryliuk
Provincial Manager, Environmental Compliance and Enforcement

c: P. Coote, Water and Waste Department, City of Winnipeg
S. Burland Ross/ A. Dey, Environmental Approvals Branch
P. Crocker/ N. Suresh/ J. Froese, Environmental Compliance and Enforcement Branch

Winnipeg | Water and Waste
Eaux et déchets

December 21, 2020

Client File No.: 3205.00
Our File Nos S-734, S-734(A) EMS
020-17-08-11-00
020-17-08-11-0N

Manitoba Conservation and Climate
Environmental Stewardship Division
Environmental Compliance and Enforcement
1007 Century Street
Winnipeg, MB R3H 0W4

Attention: Yvonne Hawryliuk, Provincial Manager, Environmental Compliance and Enforcement

RE: ENVIRONMENT ACT LICENCE NO. 3042 CLAUSE 8

This letter is in response to your August 28, 2020 letter regarding the City of Winnipeg's (City) implementation strategies and measures to comply with Environment Act Licence No. 3042 Clause 8.

The City recommends using the Combined Sewer Overflow Master Plan (CSO Master Plan) to meet Clause 8 by removing wastewater and/or land drainage contributions from the combined sewer system from multiple areas of the City in order to offset any additional wastewater and/or land drainage contributions from small scale developments. This applies for the following small scale developments in combined sewer districts:

- New single-family dwellings which are replacing older, smaller homes built prior to 1990
    - Homes built prior to 1990 have weeping tiles connected to the sewer service pipe
- New two-family dwellings which are replacing older, smaller homes built prior to 1990
    - Homes built prior to 1990 have weeping tiles connected to the sewer service pipe
- Residential, commercial and industrial interior renovations/small additions
- New single-family and two-family dwellings on vacant land
- Lot splits, with new small scale development, where the original single-family or two-family dwelling remains

The current City of Winnipeg Sewer Bylaw 106/2018 does not require the restriction of a land drainage discharge rate for a single-family or two-family property on a lot with an area of less than 1,000 square metres (Part 9 Section 64(2)).

Increases in wastewater and/or land drainage contributions from the small scale developments identified above are proposed to be offset by sewer separation works in the CSO Master Plan. As previously stated, the City is currently constructing sewer separation works in the Cockburn Calrossie combined sewer district which will reduce combined sewer overflow volume by approximately 183,000 m3. The incremental contributions from the identified small scale

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developments is small and may not be measurable on a single development basis but will grow as this type of development continues.

If the CSO Master Plan is not utilized as a strategic approach to meet Clause 8 requirements, then property owners of these smaller developments will need to accommodate on-site land drainage management to meet Clause 8. On-site land drainage management may limit development and the City's desire to densify older neighbourhoods by adding complexity to the proposed development (e.g. underground storage tank or catch basin leads with above ground storage) and maintenance for the prospective owners.

Larger scale developments in combined sewer districts will continue to comply with Clause 8 via land drainage discharge restrictions in order to offset increased wastewater contributions.

Regarding public engagement, the Department provided information to a representative of the Glenwood Neighbourhood Association via email. There were no registered delegations at the City's Standing Policy Committee on Water and Waste, Riverbank Management, and the Environment meeting on December 1, 2020. The Department is not aware of any other residential enquiries.

Should you have any questions on this please contact Michelle Paetkau at 204-986-4904 or by email at mpaetkau@winnipeg.ca.

Sincerely,

Michelle Paetkau, P. Eng.
Acting Branch Head for Wastewater Planning and Project Delivery

Geoff Patton, P. Eng.
Manager of Engineering Services Division

MP/dr

c: Siobhan Burland Ross, M. Eng., P. Eng., Manitoba Conservation and Climate (email)
M.L. Geer, CPA, CA, Water and Waste Department (email)
G.K. Patton, P. Eng., Water and Waste Department (email)
R. Grosselle, Water and Waste Department (email)
M. Paetkau, Water and Waste Department (email)
Chris Carroll, Water and Waste Department (email)

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March 18, 2021

File No.: 3205.00
Licence No.: 3042

Michelle Paetkau, P. Eng., Acting Branch Head
Wastewater Planning and Project Delivery
110-1199 Pacific Avenue
Winnipeg MB R3E 3S8
Email: mpaetkau@winnipeg.ca

Dear Michelle Paetkau:

RE: Combined Sewage Overflow (CSO) Environment Act Licence 3042
Application of Clause 8

Manitoba Conservation and Climate, Environmental Compliance and Enforcement Branch acknowledges the receipt of your letter, dated December 21, 2020 in response to Manitoba Conservation and Climate's letter dated August 28, 2020 on the above subject.

Manitoba Conservation and Climate has reviewed the information provided and has determined to fully assess compliance with Clause 8 that additional information is required. Specifically, an estimated volume that developments have increased flows to CSO and the estimated volume offset through various technology or infrastructure developments is required. Manitoba Conservation and Climate is requesting that the above information be provided by April 19, 2021. The information can be provided by sewer district, or for the overall sewershed.

Going forward, this information will be required to be submitted on an annual basis. CSO Annual report outline was initially approved on January 17, 2020. This approval is hereby amended to include the above requested information starting within the 2021 CSO Annual report.

If you have any questions, please contact Julie Froese, Environment Officer, Environmental Compliance and Enforcement Branch at Julie.Froese@gov.mb.ca, or 204-945-7104.

Yours sincerely,

Kristal Harman
Director, Environmental Compliance and Enforcement

c: Geoff Patton, P. Eng., Manager of Engineering Services Division
P. Coote, Water and Waste Department, City of Winnipeg
S. Burland Ross/ A. Dey, Environmental Approvals Branch
N. Suresh/J. Froese, Environmental Compliance and Enforcement Branch

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Conservation and Climate
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File No.: 3205.10

July 8, 2021

Michelle Paetkau, P. Eng.
Acting Branch Head
Wastewater Planning and Project Delivery
110-1199 Pacific Avenue
Winnipeg MB R3E 3S8
Email: mpaetkau@winnipeg.ca

Dear Michelle Paetkau:

This will acknowledge receipt of your letter dated April 19, 2021, in response to our March 18, 2021, letter requesting clarification on your December 21, 2020, submission.

Conservation and Climate has reviewed all the information provided on the estimated increase in volume of Combined Sewer Overflows caused by infill developments and the estimated decrease in volume as a result of infrastructure development on the overall Combined Sewer system, and has determined it satisfies the intent set out in Clause 8 of Environment Act Licence No. 3042. Future compliance with respect to Clause 8 will be assessed through our review of the information provided in the Combined Sewer Overflow (CSO) Annual Reports, starting with 2021 as requested in our March 18, 2021 letter.

As per your letter dated December 21, 2020, the City's strategy to meet Clause 8 provides offsets by sewer separation projects being completed under the CSO Master Plan for the following: increases in wastewater and/or land drainage contributions from new single and two family dwellings replacing older homes; renovations and small additions for residential, industrial, and commercial properties; and new homes on vacant land and lot splits with small scale development where the existing building remains. Further, you have also stated that larger scale developments in combined sewer districts will continue to comply with Clause 8 via land drainage discharges restriction in order to offset increased wastewater contributions.

In addition, Conservation and Climate wishes to confirm that the proposed strategy regarding small development compliance with Clause 8 applies to the overall combined sewer district for the purpose of interpretation of the above Environment Act Licence. It should be noted that the city and Conservation and Climate are of the same understanding regarding the interpretation of 'sewershed' as the overall combined sewer district and using the CSO Master Plan to achieve the Clause 8 requirements as per the deliberations at the recent CSO Milestone meeting held on May 10, 2021. The City should continue to review developments on a case by case basis to enforce compliance with Clause 8 at the broad sewershed level, the CSO Master Plan and other City standards (e.g. Sewer-By-Law, Basement Flood Relief, etc.) as required.

If you have any questions, please contact Yvonne Hawryliuk, Provincial Manager, Environmental Compliance and Enforcement Branch, at Yvonne.Hawryliuk@gov.mb.ca or 204-945-5305.

Sincerely,

Kristal Harman, Director
Environmental Compliance and Enforcement

c: Y. Hawryliuk/N. Suresh/J. Froese, Environmental Compliance and Enforcement Branch
L. Pyles/S. Burland Ross/ B. Assefa, Environmental Approvals Branch
G. Patton, P. Eng., Manager of Engineering Services Division
M.L. Geer, CPA, CA, Water and Waste Department
R. Grosselle, Water and Waste Department
C. Carroll, Water and Waste Department
P. Coote, Water and Waste Department, City of Winnipeg

Appendix D – Provincial Letter on Notification Plan

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Client File. 3205.10

January 13, 2023

Chris Carroll, P.Eng., MBA
Manager of Wastewater Services Division
110-1199 Pacific Avenue
Winnipeg Manitoba R3E 3S8
ccarroll@winnipeg.ca

Dear Chris Carroll:

RE: Combined Sewer Overflow - Environment Act Licence 3042
Clause 14 – Notification Plan
Removal of Requirement to Submit Significant Rainfall Event Notifications

Environment, Climate and Parks has been reviewing the requirements of Clause 14 of Environment Act Licence 3042. The approved plan, which was submitted in April of 2014, required regular notification of Combined Sewer Overflow (CSO) events in the form of quarterly and annual reporting of all CSO events, and the reporting of unique or significant events as required.

In July of 2022, the real time online public notification system was completed as required in Clause 10 of the licence. Now that this system is active, it has been determined that significant rainfall events will no longer be required to be reported to the department. The quarterly and annual reporting of all CSO events is still required to be submitted.

If you have any questions regarding this change, please contact Julie Froese, Environment Officer, Environmental Compliance and Enforcement Branch at Julie.Froese@gov.mb.ca or 204-945-7104.

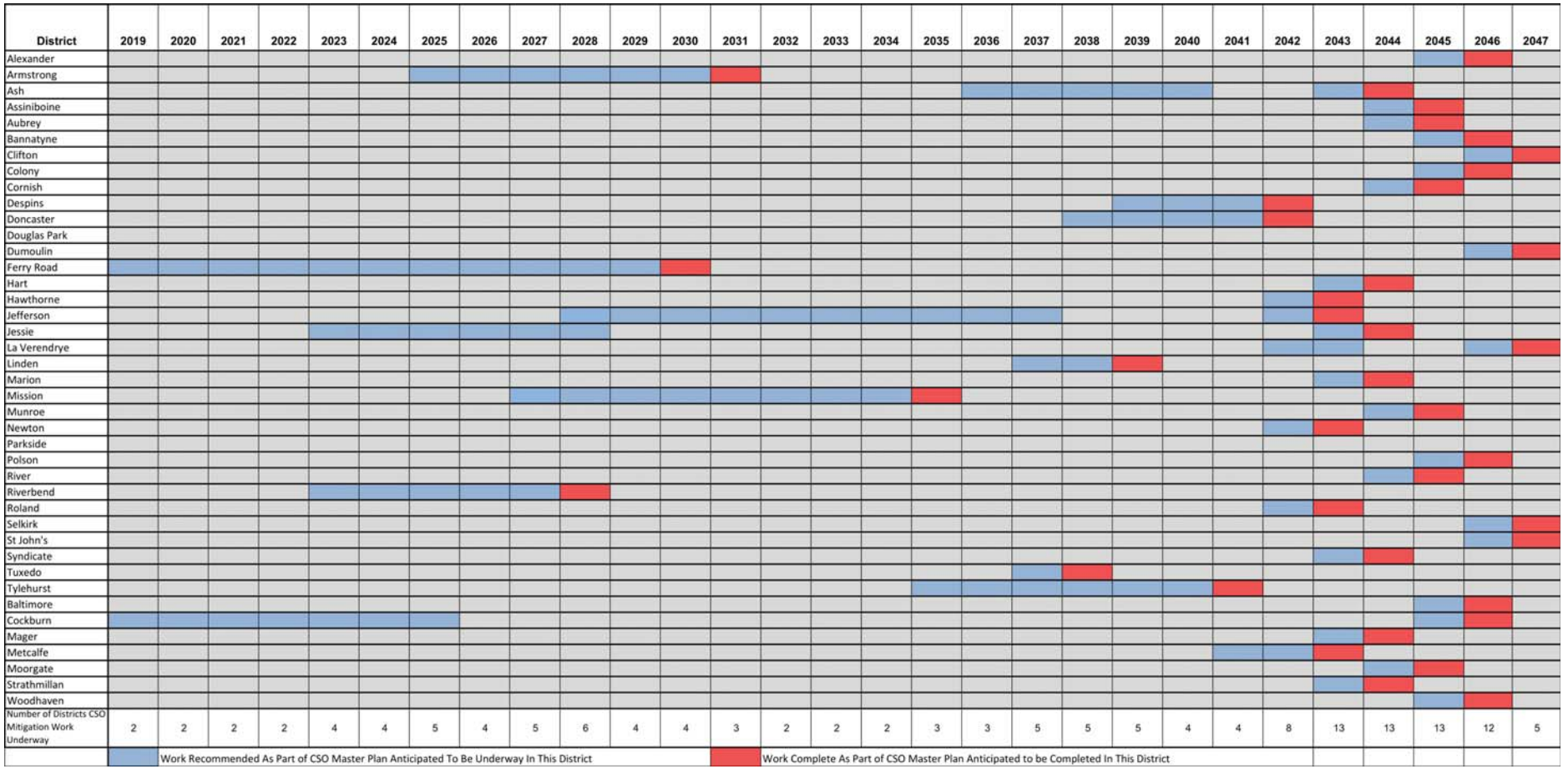
Sincerely,

WR

Warren Rospad
A/Director

c. Michael A. Jack, CAO - City of Winnipeg
Cynthia Wiebe, Renee Grossele, Susan Lambert, Michele Paetkau – City of Winnipeg, Water & Waste Department
Public Registry
James Capotosto, Siobhan Burland Ross, Bereket Assefa - Environmental Approvals
Yvonne Hawryliuk, Nada Suresh, Julie Froese - Environmental Compliance and Enforcement

Appendix E – District Program Scenario 1 Implementation Schedule



CSO Master Plan Program Scenario 1 Sewer District Based Implementation Schedule (Jacobs, 2019)