# CSO Master Plan

## River District Plan

August 2019

City of Winnipeg

# CSO Master Plan

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# 1. River District

## 1.1 District Description

River district is situated immediately south of the junction of the Assiniboine River and Red River, and is just south of downtown Winnipeg. The boundaries are the Assiniboine River to the north and west, the Red River to the east, and the Jessie combined sewer (CS) district to the south. Jessie Avenue and Daly Street act as the southern border for the district. River district is three-quarters residential and one-quarter commercial land use, with the commercial businesses located along Pembina Highway and Osborne Street. River district is a high traffic and densely populated area, with the presence of Osborne Village, which includes many restaurants, shops, and services.

The major transportation routes are Pembina Highway, Donald Street, and Osborne Street; each of which travel north into downtown Winnipeg or south into the Jessie district. The Canadian National Railway Mainline passes over Osborne Street and parallel with Donald Street. It travels north towards The Forks in the Bannatyne district and south into Jessie district.

The residential section of River district is a mix of single-family houses to the west and high-rise apartments predominately based along the Assiniboine River. A major non-residential feature is the Winnipeg Winter Club, which is located on the southeastern corner of River Avenue and Donald Street. The Southwest Bus Rapid Transit Corridor travels along the eastern boundary of the River District and ends at Queen Elizabeth Way.

Approximately 21 ha of the River district is made up of greenspace, which includes Gerald James Lynch Park, Fort Rouge Park, and Mayfair Park East and West, all located on River Avenue. South Point Park is located in the northern corner of the district.

## 1.2 Development

River district includes a significant portion of the Osborne Village area, and the potential for redevelopment and further densification in the future is high. Redevelopment within this area could impact the CS and will be investigated on a case-by-case basis for potential impacts to the combined sewer overflow (CSO) Master Plan. All developments within the CS districts are mandated to offset any peak combined sewage discharge by adding localized storage and flow restrictions, in order to comply with Clause 8 of the Environment Act License 3042.

The Southwest Bus Rapid Transit Corridor is also located along the eastern boundary of the River District. Existing land adjacent to this transit corridor will be prioritized to be developed into a higher density, mixed-use community, to align with Transit Oriented Development (TOD) principles.

A portion of Pembina Highway and Osborne Street are located within River district. These streets are identified as Regional Mixed Use Corridors as part of the Our Winnipeg future development plans. As such, focused intensification along Pembina Highway and Osborne Street is to be promoted in the future.

## 1.3 Existing Sewer System

The River district has an approximate area of 130 ha[1] based on the district boundary. The district is serviced by both a CS system and storm relief sewer (SRS) system. There is a small section serviced by a land drainage sewer (LDS). There is no separated or separation ready areas.

[1] City of Winnipeg GIS information relied upon for area statistics. The GIS records may vary slightly from the city representation in the InfoWorks sewer model. Therefore, minor discrepancies in the area values reported in Section 1.3 Existing Sewer System, and in Section 1.8 Performance Estimate may occur.

River district receives the sewage from the Jessie district through dual 300 mm force mains that connect into the 600 mm secondary interceptor pipe on Clarke Street. The Clarke Street secondary interceptor then connects to the CS trunk on River Avenue. As a result the intercepted combined sewage from the Jessie district is intercepted once more by the primary weir in the River district. The River district also receives pumped combined sewage flow from the Marion district through a 500 mm force main. The Marion LS force main connects into the Mayfair LFPS force main downstream of the LFPS.

The CS system includes a combined lift and flood pump station (LFPS), one combined FPS and CS outfall and one SRS outfall. All domestic wastewater and CS flows collected in River district are routed to Mayfair Avenue, where the Mayfair LFPS and outfall are located. Sewage primarily flows through the main 1000 by 1500 mm CS trunk that runs eastbound on River Avenue. All minor CSs within River district connect to the main CS trunk including flow from Jessie district. The force main from Jessie connects to this main CS at the eastern edge of River Avenue. A CS varying in size runs along Nassau Street North collecting combined sewage from the south western part of the River district. All other streets include minor CSs that flow by gravity towards the main CS trunks and Mayfair LFPS. The height of the existing primary weir in the Mayfair LFPS is high enough that it negates the need to add a control gate to utilize additional in-line storage. A level of in-line storage is provided by the existing primary weir height. This is discussed in further detail in Section 1.6.3 below.

During heavy rainfall events, the SRS system provides relief to the CS system in the River district. Most catch basins are still connected into the CS system, so the SRS acts as an overflow conduit for the CS system with the captured CS flow continuing to the Mayfair CS LS. The SRS system was completed in 1967, with a main 1650 mm trunk along Scott Street, and connects to a dedicated SRS outfall pipe at Fort Rouge Park off River Avenue. A flap gate and sluice gate installed along the outfall pipe prevents river water from backing up into the SRS system under high river level conditions. Latent storage pumps are located upstream of the flap gate. Where high river levels keep the flap gate closed, the pumps keep the SRS dewatered following wet weather events. The pumps discharge upstream of the River district primary weir, but are prevented from dewatering in the event of high levels in the River CS System. SRS sub-trunks along River Avenue, Clarke Street, Roslyn Road, and Stradbrook Avenue branch out from the main SRS trunk sewer. In addition, there are SRS which relief existing combined sewers on Wellington Crescent, Wardlaw Avenue, and Gertrude Avenue, and re-connect to the CS system on the CS trunk on Osborne Street.

A minor land drainage sewer (LDS) system within the River district services a portion of the Southwest Transit Corridor. The majority of this LDS connect directly to the River LFPS where both the overflow from the CS system and the LDS flow gravity through a combined outfall pipe to the Assiniboine River. A portion of the LDS system installed with the Southwest Transit Corridor also ties into the existing SRS system. There is also localized LDS installation work installed in the southeast corner of the River district servicing businesses surrounding the Osborne Junction. This LDS work also eventually ties into the SRS system.

During dry weather flow (DWF), intercepted sewage flows are directed by the primary weir to the Mayfair LFPS and pumped across the Assiniboine River via a 500 mm and 600 mm dual river crossing to connect to the Main interceptor in the Bannatyne district. The Main interceptor then eventually reaches the North End Sewage Treatment Plant (NEWPCC) for treatment.

During wet weather flow (WWF), any flow that exceeds the diversion capacity of the primary weir is discharged into the River CS/FPS outfall, where it flows to the Red River by gravity.. Sluice and flap gates are installed on the CS outfall to prevent back-up of the Assiniboine River into the systems under high river level conditions. Under these high river level conditions and when gravity discharge through the outfall is not possible, the excess flow is pumped within the LFPS and redirected to a point in the combined outfall downstream of the flap and positive gates allowing gravity discharge to the river once more. Note that the Mayfair LFPS utilizes the same pumps for both pumping intercepted CS to the river crossing as mentioned above, and for redirecting excess CS to the CS outfall under high river level conditions. A small LDS system also discharges to the LFPS, collecting storm flows from a small area along Stradbrook Avenue, and discharges to the Mayfair LFPS downstream of the primary weir.

The two outfalls (one CS and one SRS) to the Assiniboine River are as follows:

- ID70 (S-MA70004387) – River CS/FPS Outfall
- ID67 (S-MA60020193) – Fort Rouge Park SRS Outfall

### 1.3.1 District-to-District Interconnections

There are several district-to-district interconnections between the River district and the surrounding districts. Each interconnection is shown on Figure 34 and shows gravity and pumped flow from one district to another. Each interconnection is listed as follows:

#### 1.3.1.1 Interceptor Connections – Downstream of Primary Weir

**Bannatyne**

- Two force mains (600 mm and 500 mm diameter) convey sewage across the Assiniboine River at Queen Elizabeth Way and Main Street flow out of River district into Bannatyne district:
  - Invert at Queen Elizabeth Way in Bannatyne district, flowing from River District – 227.72 m
  - Invert at Queen Elizabeth Way in Bannatyne district, flowing from River District – 227.72 m

#### 1.3.1.2 Interceptor Connections – Upstream of Primary Weir

**Jessie**

- The Jessie CS LS has two 300 mm force mains that convey flow into River district from Jessie district:
  - Southwest Transit Corridor and Jessie Avenue invert at district boundary – 230.41 m

**Marion**

- A 500 mm force main conveys sewage from Marion CS LS and across the Red River at Queen Elizabeth Way and St. Mary's Road flowing from Marion district into River district:
  - Invert at Queen Elizabeth Way in River district, flowing from Marion district – 225.06 m

#### 1.3.1.3 District Interconnections

**Jessie**

<u>CS to SRS</u>

- A 450 mm SRS discharges into Jessie district CS system at the intersection of Jessie Avenue, between Pembina Highway and Osborne Street:
  - Southern River District SRS Tie-In – 224.35 m (S-MA70010953)
- A 350 mm SRS in the River district discharges into Jessie CS system by gravity flow at the intersection of Corydon Avenue and Daly Street:
  - Corydon Avenue SRS Tie-In – 228.353 m (S-MH60008961)
- A 250 mm SRS in the River district CS discharges into Jessie CS system by gravity flow at the intersection of McMillan Avenue and Daly Street:
  - McMillan Avenue SRS Tie-In – 228.32 m (S-MH70016737)
- High Sewer Overflow (SRS overflow pipe connects River's CS to Jessie's CS system).
  - Wellington Crescent & Gertrude - 229.06 m (S-MH60017449)

A district interconnection schematic is included as Figure 1-1. The drawing illustrates the collection areas, interconnections, pumping systems, and discharge points for the existing district.

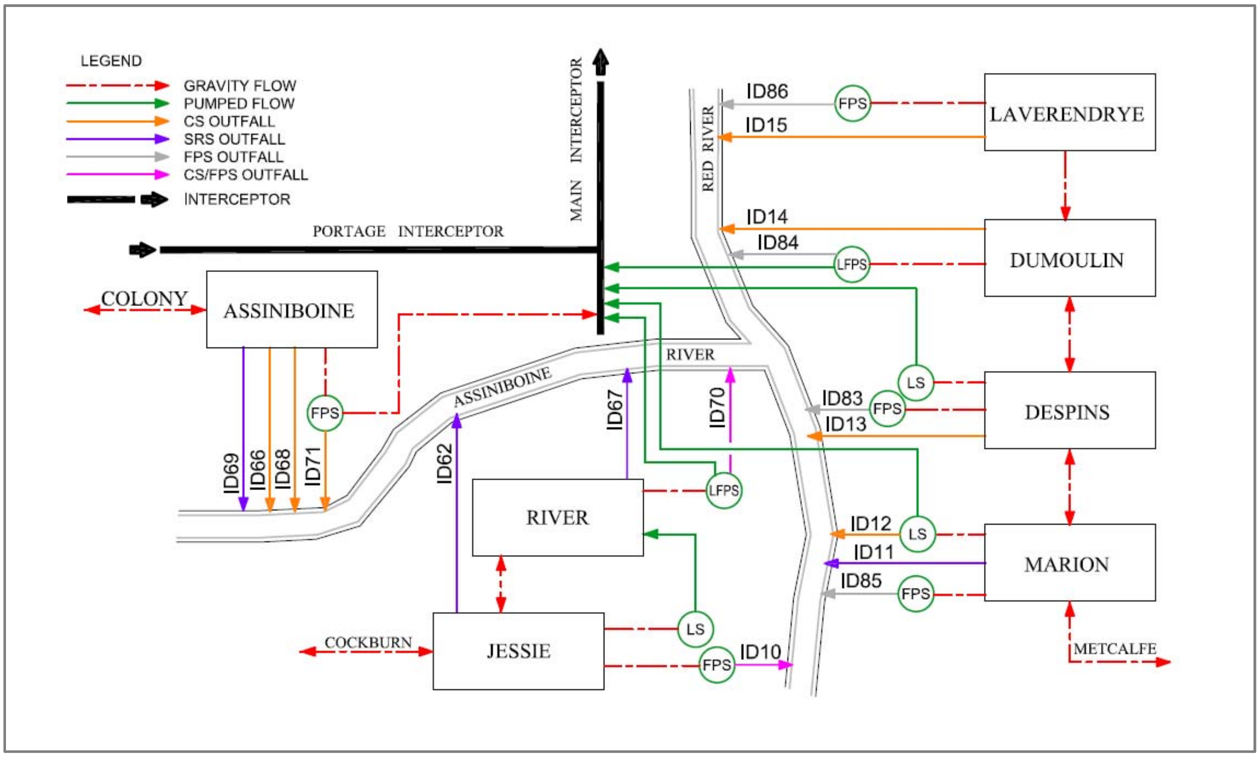


**Figure 1-1. District Interconnection Schematic**

### 1.3.2 Asset Information

The main sewer system features for the district are shown on Figure 34 and are listed in Table 1-1.

**Table 1-1. Sewer District Existing Asset Information**

| Asset | Asset ID (Model) | Asset ID (GIS) | Characteristics | Comments |
|---|---|---|---|---|
| Combined Sewer Outfall (ID70) | S-TE70001756.1 | S-MA70004375 | 1600 mm | Invert: 221.71 m |
| Flood Pumping Outfall (ID70) | S-MH70010676.1 | S-MA70029012 | 1600 mm | Invert: 221.71 m |
| Other Overflows | N/A | N/A | N/A | |
| Main Sewer Trunk | S-MH60006079.3 | S-MA70029065 | 1350 mm | Invert: 222.94 m |
| Storm Relief Sewer Outfall (ID67) | S-CO60007999.1 | S-MA60020193 | 2400 mm | Invert: 221.61 m |
| Storm Relief Sewer Interconnections | N/A | N/A | N/A | |
| Main Trunk Flap Gate | RIVER_GC1.1 | S-CG00001081 | 1600 mm | Invert: 222.50 m |
| Main Trunk Sluice Gate | RIVER_GC2.1 | S-CG00001082 | 1600 mm | Invert: 222.33 m |
| Off-Take | N/A | N/A | N/A | CS trunk flows directly into wet well and is either intercepted or discharged. |
| Dry Well | N/A | N/A | N/A | |
| Lift Station Total Capacity | N/A | N/A | 0.49 $m^3/s$ | 1 x 0.275 $m^3/s$<br>1 x 0.215 $m^3/s$ |
| Lift Station ADWF | N/A | N/A | 0.119 $m^3/s$ | |

**Table 1-1. Sewer District Existing Asset Information**

| Asset | Asset ID (Model) | Asset ID (GIS) | Characteristics | Comments |
|---|---|---|---|---|
| Lift Station Force Main | S-BE70001773.1 | S-MA70012102 | 600 mm | Discharge Invert 224.77 m |
| Flood Pump Station Total Capacity | N/A | N/A | 0.95 $m^3/s$ | LFPS combined, single pump |
| Pass Forward Flow – First Overflow | N/A | N/A | 0.55 $m^3/s$ | |

Notes:

ADWF = average dry-weather flow
GIS = geographic information system
ID = identification
N/A = not applicable

The critical system elevations for the existing system relevant to the development of the CSO control options are listed in Table 1-2. Critical elevation reference points are identified on the district overview and detailed maps.

**Table 1-2. Critical Elevations**

| Reference Point | Item | Elevation (m)[a] |
|---|---|---|
| 1 | Normal Summer River Level | River/Mayfair – 223.83<br>Fort Rouge Park – 223.83 |
| 2 | Trunk Invert at Off-Take | N/A |
| 3 | Top of Weir | 224.00 |
| 4 | Relief Outfall Invert (Upstream of Fort Rouge Gate Chamber) | 221.72 |
| 5 | Low Relief Interconnection (S-MH60017478) | 224.62 |
| 6 | Sewer District Interconnection (S-MA70010953) | Invert at district boundary: 34-02 = 224.35 |
| 7 | Low Basement | 230.28 |
| 8 | Flood Protection Level | 229.91 |

[a] City of Winnipeg Data, 2013

## 1.4 Previous Investment Work

Table 1-3 provides a summary of the district status in terms of data capture and study. The most recent study completed in River was the 1986 Basement Flooding Relief Program Review (Girling & Sharp, 1986). No other work has been completed on the district since that time.

Between 2009 and 2015, the City invested $12 million in the CSO Outfall Monitoring Program. The program was initiated to permanently install instruments in the primary CSO outfalls. The outfall from the River Combined Sewer District was included as part of this program. Instruments installed at each of the 39 primary CSO outfall locations has a combination of inflow and overflow level meters and flap gate inclinometers if available.

A latent pump and gate chamber have been constructed on the Fort Rouge Park SRS pipe. This work was completed in 2017 and upgraded the existing SRS gate chamber with a new dual chamber attached to the existing chamber that provided new sluice and flap gates on the SRS pipe. The existing chamber was re-designed as a latent pump chamber with a new submersible pump and a new force main connecting back to the CS system on River Avenue.

From 2009 – 2012 the Southwest Rapid Transit Corridor for the City of Winnipeg was constructed. A portion of this major development was constructed in the River district. As part of this work a local LDS system was installed to capture all surface runoff from the corridor itself. This LDS system ultimately ties back into the River district at various points.

**Table 1-3. District Status**

| District | Most Recent Study | Flow Monitoring | Hydraulic Model | Status | Planned Completion |
|---|---|---|---|---|---|
| 34 - River | 1986 | Ongoing | 2013 | Complete | N/A |

## 1.5 Ongoing Investment Work

There is ongoing maintenance and calibration of permanent instruments installed within the primary outfall of the River district. This consists of monthly site visits in confined entry spaces to verify physical readings concur with displayed transmitted readings and replacing desiccants where necessary.

Specific to the Fort Rouge SRS, an ongoing annual flow monitoring program will be completed to assess the performance of the Fort Rouge latent storage facility previously constructed.

## 1.6 Control Option 1 Projects

### 1.6.1 Project Selection

The proposed projects selected to meet Control Option 1 – 85 Percent Capture in a Representative Year for the River sewer district are listed in Table 1-4. The proposed CSO control projects will include screening installation primarily. In-line storage and latent storage facilities are either already provided by existing infrastructure, or have already been recently implemented within this district and are described in the sub-sections below. Program opportunities including green infrastructure (GI) and real time control (RTC) will also be included as applicable.

**Table 1-4. District Control Option**

| Control Limit | Latent Storage | Flap Gate Control | Gravity Flow Control | Control Gate | In-line Storage | Off-line Storage | Storage / Transport Tunnel | Sewer Separation | Green Infrastructure | Real Time Control | Floatable Management |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 85 Percent Capture in a Representative Year | | - | - | - | | - | - | - | ✓ | ✓ | ✓ |

Notes:

- = not included
✓ = included

The River district has an existing primary weir elevation of 224 m just upstream of the River CS outfall and located inside the LFPS. The height of the existing weir is high enough that it negates the need to add a control gate to utilize additional in-line storage. The weir height is already above the sewer obvert. The existing height of the weir provides an existing in-line storage of 508 $m^3$ when evaluated against the 1992 representative year, and will continue to operate in this fashion.

The City has also previously completed the SRS latent storage arrangements utilizing the Fort Rouge Park SRS outfall. This project is discussed in further detail in Section 1.6.2 below.

Floatable control will be necessary to capture floatables in the sewage. Floatables will be captured with all implemented control options to some extent, but screening may be added as required to reach the desired level of capture. The screening arrangement for River will be located on the CS trunk and upstream from the Mayfair LFPS.

GI and RTC will be applied within each district on a system wide basis with consideration of the entire CS area. The level of implementation for each district will be determined through evaluations completed through district level preliminary design. RTC is not included in detail within each plan and is described further in Section 3 of Part 3A.

### 1.6.2 Latent Storage

Latent storage is a suitable control option for the River district for the utilizing the Fort Rouge SRS system. Latent storage has been recently installed in the district at the Fort Rouge SRS outfall and has been included as part of the CSO Master Plan performance evaluation. The latent storage level in the system is controlled by the river level, and the resulting backpressure of the river level on the SRS outfall flap gate, as explained in Part 3C. The latent storage design criteria which was utilized in the 2017 design is identified in Table 1-5. The storage volumes indicated in Table 1-5 are based on the NSWL river level conditions over the course of the 1992 representative year.

**Table 1-5. Latent Storage Design Criteria**

| Item | Elevation/Dimension | Comment |
|---|---|---|
| Invert Elevation | 221.95 m | |
| NSWL | 223.83 m | |
| Trunk Diameter | 2400 / 1200 mm | Two different pipes upstream from gate chamber |
| Design Depth in Trunk | 1880 mm | |
| Maximum Storage Volume | 1284 $m^3$ | |
| Force Main | 150 mm | |
| Flap Gate Control | N/A | |
| Lift Station | N/A | In-line pump |
| Nominal Dewatering Rate | 0.07 $m^3/s$ | Based on existing pump capacity |
| RTC Operational Rate | TBD | Future RTC/dewatering review on assessment |

Note:

NSWL = normal summer water level

The existing latent pumping system is located within the SRS outfall gate chamber located along River Avenue between Cauchon Street and Scott Street. Figure 34-02 provides an overview of the gate chamber and connections to the CS system constructed as part of this recent work. A dual chamber was constructed adjacent to the existing gate chamber and provided new sluice and flap gates on the SRS outfall pipe. The existing chamber was then re-designed as a latent pump chamber with a new submersible pump and a new force main. The force main pumps into the nearby 900 mm x 1350 mm CS pipe into the manhole (S-MH60017500) on River Avenue. The operational intent is for the existing latent pump to dewater the SRS system in preparation for the next runoff event. This would align with the requirement for the system to be ready for the next event within a 24-hour period after completion of the previous event.

Figure 34 identifies the extent of the SRS system within the River district that is being used now to provide latent storage. The maximum storage level as part of the CSO Master Plan performance evaluation is directly related to the NSWL and the size and depth of the SRS system. Once the level in the SRS exceeds the river level, the flap gate opens to allow discharge to the Assiniboine River.

The lowest interconnection between the combined sewer and SRS systems is higher than the proposed latent and in-line storage control levels, meaning that the two systems would function independently.

As part of the evaluation of the latent storage volume was completed using the continuous NSWL river conditions, This NSWL was found to utilize 90 percent of the SRS pipe height with the existing latent storage arrangements and, therefore, additional flap gate control was not recommended as a further measure to provide the required latent storage as part of the CSO Master Plan.

In situations where non modelled assessments are to be completed, the actual river levels will be both lower and higher than the NSWL level at various points throughout an annual year. Where the level is below the NSWL, the latent volume will be less than predicted during the MP assessment, while conversely when the level is above the NSWL, the latent volume will be more than predicted. The continuous assessment is seen as a conservative approach since the majority of the representative year rainfall events occur when the river levels are higher than the NSWL.

### 1.6.3 In-Line Storage

Any potential additional in-line storage within the River district via control gate construction has already been maximized based on the height of the existing primary weir in this district. The primary outfall consists of a combined lift and FPS with the primary weir located inside. The existing in-line storage will not require a control gate due to the existing height of the weir, but will still utilize the existing combined sewers for in-line storage. The obvert of the main trunk rests at 224.25 m, and the top of primary weir elevation rests close to this obvert elevation at 224 m. Therefore no further work associated with in-line storage is proposed for the River district.

The nominal rate for dewatering is set at the existing LS capacity. This allows dewatering through the existing interceptor system within 24 hours following the runoff event, allowing it to recover in time for a subsequent event. Future RTC / dewatering assessment will be necessary to define additional rates. This would provide some flexibility in the ability to increase the dewatering rate for spatial rainfall events. This would dewater the district more quickly, to capture and treat more volume for these localized storms by using the excess interceptor capacity where the runoff is less.

### 1.6.4 Floatables Management

Floatables management will require installation of a screening system to capture floatable materials that bypass the LS. There are limitations in the application of an off-line screening arrangement at this location due to the primary weir being located within the LFPS structure. As well, a separate LDS connection is also located within the LFPS. Therefore, in order to accommodate screening of this outfall, an arrangement is proposed to bypass the existing primary weir via a new pipe to transfer excess CS collected to the screened chamber. All screened flow would then tie back into the LFPS chamber downstream of the primary weir, where it can be discharged to the Assiniboine River. This would occur for the first flush flow as per normal screening operation noted in other district screening operations.

The type and size of screens depend on the specific station configuration and the head available for operation. A standard design was assumed for screening and is described in Part 3C. The design criteria for screening are listed in Table 1-6.

**Table 1-6. Floatables Management Conceptual Design Criteria**

| Item | Elevation/Dimension/Rate | Comment |
|---|---|---|
| Top of Gate | 224.00 m | |
| Bypass Weir Crest | N/A | Existing high level weir |
| Normal Summer River Level | 223.83 m | |

| | | |
|---|---|---|
| Maximum Screen Head | 0.17 m | |
| Peak Screening Rate | 0.96 $m^3/s$ | |
| Screen Size | 1.5 m wide x 1 m high | Modelled Screen Size |

The proposed screening chamber will be located in-line on the existing 1350 mm CS trunk and upstream of the existing primary weir, as shown on Figure 34-01. Within the new screening chamber, it is proposed that the flow in the CS trunk would overtop the bypass side weir, situated within the 1350mm trunk pipe wall, and this will flow through the screens. also located in the new screening chamber. The screened flow will be discharged to the existing LFPS downstream of the primary weir via new pipework and then overflow as per existing conditions via gravity/pumped and discharge to the river. The screening chamber will include screenings pumps with a discharge returning the screened material to the CS LS for routing to the NEWPCC for removal. High flows would be still be directed to the primary weir as per existing conditions.

#### 1.6.5 Green Infrastructure

The approach to GI is described in Section 5.2.1 of Part 2 of the CSO Master Plan. Opportunities for the application of GI will be evaluated and applied with any projects completed in the district. Opportunistic GI will be evaluated for the entire district during any preliminary design completed. The land use, topography and soil classification for the district was reviewed to identify the most applicable GI controls.

River has been classified as a medium GI potential district. Land use in River is mostly single-family residential, with the remaining consisting of commercial land use. This means the district would be an ideal location for bioswales, permeable paved roadways, cisterns/rain barrels. The flat roof commercial buildings make for an ideal location for green roofs.

#### 1.6.6 Real Time Control

The approach to RTC is described in Section 5.2.2 of Part 2 of the CSO Master Plan. The application of RTC will be evaluated and applied on a district by district basis through the CSO Master Plan projects with long term consideration for implementation on a system wide basis.

### 1.7 System Operations and Maintenance

System operations and maintenance (O&M) changes will be required to address the proposed control options. This section identifies general O&M requirements for each control option proposed for the district. More specific details on the assumptions used for quantifying the O&M requirements are described in Part 3C of the CSO Master Plan.

The latent storage facilities constructed will take advantage of the SRS infrastructure already in place; therefore, minimal additional maintenance will be required for the sewers. The latent LS and dewatering pumps will require regular maintenance that would depend on the frequency of operation. Additional system monitoring, and level controls will be installed which will require regular scheduled maintenance.

Floatable control with outfall screening will require another chamber with screening equipment installed. The chamber will be upstream of the existing weir due to the weir being located within the LFPS structure. Screening operation will occur during WWF events that surpass the existing in-line storage control level. WWF will flow over the bypass weir and through the screens directed to discharge into the river via a new transfer pipe and the existing outfall pipe. The screens will operate intermittently during wet weather events and will likely require operations review and maintenance after each event. The frequency of a screened event would correlate to the number overflows identified for the district. The screenings return will require a small LS and force main to pump this back to the CS trunk. Additional maintenance for the pump will be required at regular intervals in line with typical lift station maintenance after screening events.

## 1.8 Performance Estimate

An InfoWorks CS hydraulic model was created as part of the CSO Master Plan development. Two versions of the sewer system model were created and used to measure system performance. The 2013 Baseline model represents the sewer system baseline in the year 2013 and the 2037 Master Plan – Control Option 1 model, which includes the proposed control options in the year 2037. A summary of relevant model data is provided in Table 1-7.

**Table 1-7. InfoWorks CS District Model Data**

| Model Version | Total Area (ha) | Contributing Area (ha) | Population | % Impervious | Control Options Included in Model |
|---|---|---|---|---|---|
| 2013 Baseline | 121 | 121 | 10,214 | 38 | N/A |
| 2037 Master Plan – Control Option 1 | 121 | 121 | 10,214 | 38 | LS, SC |

Notes:

Total area is based on the model subcatchment boundaries for the district.
LS = Latent Storage (Latent Storage was constructed by the City in 2017)

SC = Screening
No change to the future population was completed as from a wastewater generation perspective from the update to the 2013 Baseline Model to the 2037 Master Plan Model. The population generating all future wastewater will be the same due to Clause 8 of Environment Act Licence 3042 being in effect for the CS district.

City of Winnipeg hydraulic model relied upon for area statistics. The hydraulic model representation may vary slightly from the City of Winnipeg GIS Records. Therefore, minor discrepancies in the area values reported in Section 1.3 Existing Sewer System, and in Section 1.8 Performance Estimate may occur.

The performance results listed in Table 1-8 are for the hydraulic model simulations using the year-round 1992 representative year. This table lists the results for the Baseline, for each individual control option and for the proposed CSO Master Plan - Control Option 1. The Baseline and Control Option 1 performance numbers represent the comparison between the existing system and the proposed control options. Table 1-8 also includes overflow volumes specific to each individual control option; these are listed to provide an indication of benefit gained only and are independent volume reductions.

**Table 1-8. District Performance Summary – Control Option 1**

| | Preliminary Proposal | Master Plan | | | |
|---|---|---|---|---|---|
| Control Option | Annual Overflow Volume ($m^3$) | Annual Overflow Volume ($m^3$) | Overflow Reduction ($m^3$) | Number of Overflows | Pass Forward Flow at First Overflow [a] |
| Baseline (2013) | 11,331 | 15,904 | - | 11 | 0.490 $m^3$/s |
| Latent Storage | 8,452 | 15,904 | 0 | 11 | 0.490 $m^3$/s |
| **Control Option 1** | **8,452** | **15,904** [b] | **0** | **11** | **0.490 $m^3$/s** |

[a] Pass forward flows assessed on the 1-year design rainfall event

[b] Model influenced by other districts performance

A slight increase to the overflow volume was found when modeling the system with the control options implemented. This is believed to be due to the influence from other districts discharging to the interceptor sewer upstream of the connection point for the River district. This will require further modelling to establish suitable option to reduce flows and assess the performance of the existing SRS system.

The percent capture performance measure is not included in Table 1-8, as it is applicable to the entire CS system and not for each district individually.

## 1.9 Cost Estimates

Cost estimates were prepared during the development of the Preliminary Proposal and have been updated for the CSO Master Plan. The CSO Master Plan cost estimates have been prepared for each control option, with overall program costs summarized and described in Section 3.4 of Part 3A. The cost estimate for each control option relevant to the district as determined in the Preliminary Proposal and updated for the CSO Master Plan are identified in Table 1-9. The cost estimates are Class 5 planning level estimates with a level of accuracy of minus 50 percent to plus 100 percent.

**Table 1-9. Cost Estimates – Control Option 1**

| Control Option | 2014 Preliminary Proposal Capital Cost | 2019 CSO Master Plan Capital Cost | 2019 Annual Operations and Maintenance Cost | 2019 Total Operations and Maintenance Cost (Over 35-year period) |
|---|---|---|---|---|
| Latent | $1,740,000 | N/A | N/A | N/A |
| Screening | N/A [a] | $2,950,000 [b c] | $44,000 | $950,000 |
| **Subtotal** | **$1,740,000** | **$2,950,000** | **$44,000** | **$950,000** |
| Opportunities | N/A | $300,000 | $4,500 | $100,000 |
| **District Total** | **$1,740,000** | **$3,250,000** | **$48,500** | **$1,050,000** |

[a] Solution developed as refinement to Preliminary Proposal work following submission of Preliminary Proposal costs. Costs for the screening item of work found to be $590,000 in 2014 dollars

[b] Costs associated with new pipework including offtake construction, as required, to accommodate screening chamber in the location proposed and allow intercepted CS flow to reach existing River CS LS was not included in the Master Plan cost assessment.

[c] Cost for bespoke screenings return/force main not included in Master Plan as will depend on selection of screen and type of screening return system selected

The estimates include changes to the control option selection since the Preliminary Proposal, updated construction costs, and the addition of GI opportunities. The calculations for the CSO Master Plan cost estimate includes the following:

- Capital costs and O&M costs are reported in terms of present value.
- A fixed allowance of 10 percent has been included for GI, with no additional cost for RTC. This has been listed as part of the Opportunities costs.
- The Preliminary Proposal capital cost is in 2014-dollar values.
- The CSO Master Plan capital cost is based on the control options presented in this plan and in 2019-dollar values.
- The 2019 Total Annual Operations and Maintenance (over 35-year period) cost component is the present value costs of each annual O&M cost under the assumption that each control option was initiated in 2019.
- The 2019 Annual Operations and Maintenance Costs were based on the estimated additional O&M costs annually for each control option in 2019 dollars.
- Future costs will be inflated to the year of construction.

Cost estimates were prepared during the development of the Preliminary Proposal and updated for Phase 3 during the CSO Master Plan development. The differences identified between the Preliminary Proposal and the CSO Master Plan are accounting for the progression from an initial estimate used to compare a series of control options, to an estimate focusing on a specific level of control for each district.

Any significant differences between the Preliminary Proposal and CSO Master Plan estimates are identified in Table 1-10.

**Table 1-10. Cost Estimate Tracking Table**

| Changed Item | Change | Reason | Comments |
|---|---|---|---|
| Control Options | Latent | Latent storage is already installed in the River district | Not included in Master Plan cost estimate. |
| | Screening | Unit cost for this control option updated for the Master Plan | |
| Opportunities | A fixed allowance of 10 percent has been included for program opportunities | Preliminary Proposal estimate did not include a cost for GI opportunities | |
| Lifecycle Cost | The lifecycle costs have been adjusted to 35 years | City of Winnipeg Asset Management approach | |
| Cost escalation from 2014 to 2019 | Capital Costs have been inflated to 2019 values based on an assumed value of 3 percent per for construction inflation. | Preliminary Proposal estimates were based on 2014 dollar values. | |

## 1.10 Meeting Future Performance Targets

The regulatory process requires consideration for upgrading Control Option 1 to another higher-level performance target. For the purposes of this CSO Master Plan, the future performance target is 98 percent capture for the representative year measured on a system-wide basis. This target will permit the number of overflows and percent capture to vary by district to meet 98 percent capture. Table 1-11 provides a description of how the regulatory target adjustment could be met by building off the proposed work identified for Control Option 1.

Overall the River district would be classified as a low potential for implementation of complete sewer separation as the only feasible approach to achieve the 98 percent capture future performance target in the representative year. However, opportunistic sewer separation within a portion of the district may be completed in conjunction with other major infrastructure work to address future performance targets. In addition, green infrastructure and off-line tank or tunnel storage may be utilized in key locations to provide additional storage and increase capture volume

**Table 1-11. Upgrade to 98 Percent Capture in a Representative Year Summary**

| Upgrade Option | Viable Migration Options |
|---|---|
| 98 Percent Capture in a Representative Year | • Opportunistic Separation<br>• Increased use of GI<br>• Off-Line Storage (Tank/Tunnel) |

The control options selected for the River district have been aligned for the 85 percent capture performance target based on the results from the system wide basis. The expandability of this district to meet the 98 percent capture is to be determined on system wide basis. Additional separation in this district may be difficult due to the heavy traffic and development density.

The cost for upgrading to meet an enhanced performance target depends on the summation of all changes made to control options in individual districts and has not been fully estimated at this stage of master planning. The Phase In approach is to be presented in detail in a second submission for 98 percent capture in a representative year, due on or before April 30, 2030.

## 1.11 Risks and Opportunities

The CSO Master Plan and implementation program are large and complex, with many risks having both negative and positive effects. The objective of this section is to identify significant risks and opportunities for each control option within a district.

The CSO Master Plan has considered risks and opportunities on a program and project delivery level, as described in Section 5 of Part 2 of the CSO Master Plan. A Risk And Opportunity Control Option Matrix covering the district control options has been developed and is included as Appendix D in Part 3B. The identification of the most significant risks and opportunities relevant to this district are provided in Table 1-12.

**Table 1-12. Control Option 1 Significant Risks and Opportunities**

| Risk Number | Risk Component | Latent Storage / Flap Gate Control | In-line Storage / Control Gate | Off-line Storage Tank | Off-line Storage Tunnel | Sewer Separation | Green Infrastructure | Real Time Control | Floatable Management |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Basement Flooding Protection | R | - | - | - | - | - | - | - |
| 2 | Existing Lift Station | - | - | - | - | - | - | R | - |
| 3 | Flood Pumping Station | - | - | - | - | - | - | - | - |
| 4 | Construction Disruption | - | - | - | - | - | - | - | - |
| 5 | Implementation Schedule | - | - | - | - | - | - | R | - |
| 6 | Sewer Condition | R | - | - | - | - | - | - | - |
| 7 | Sewer Conflicts | R | - | - | - | - | - | - | - |
| 8 | Program Cost | O | - | - | - | - | - | - | O |
| 9 | Approvals and Permits | - | - | - | - | - | R | - | - |
| 10 | Land Acquisition | - | - | - | - | - | R | - | - |
| 11 | Technology Assumptions | R | - | - | - | - | O | O | - |
| 12 | Operations and Maintenance | R | - | - | - | - | R | O | R |
| 13 | Volume Capture Performance | O | - | - | - | - | O | O | - |
| 14 | Treatment | R | - | - | - | - | O | O | R |

Risks and opportunities will require further review and actions at the time of project implementation.

## 1.12 References

Girling, R.M. and E.J. Sharp. 1986. *Basement Flooding Relief Program Review - 1986*. Month of publication if available.


**LEGEND**

- Primary Weir
- Critical Elevation
- CSO Outfall
- Low CS Manhole
- Low SRS Connection

Inter-System Connection
- CS - LDS
- CS - WWS
- SRS - CS

District Boundary Crossing
- SRS
- WWS

- Existing Latent Storage Limit
- Extent of Existing In-line Storage
- Interceptor Sewer
- Force Main
- Street
- Railway

- District Boundary
- Watercourse
- Greenspace
- City Owned Land

**CSO MASTER PLAN PROPOSED SOLUTIONS**

- Screening

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

JACOBS

Notes:
1. Map data source - City of Winnipeg, 2013

Winnipeg

**THE CITY OF WINNIPEG**
**WATER AND WASTE DEPARTMENT**

**FIGURE 34**
**District Overview Map**
**Sewer District: River**
City of Winnipeg
*Combined Sewer Overflow Master Plan*

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**LEGEND**

- Primary Weir
- CSO Outfall
- Manhole
- Flap Gate
- Sluice Gate
- Pump Location
- Force Main
- Sewer By Type
  - CS
  - LDS
  - WWS
- Control Structure Type
  - Gate Chamber
- Pump Station Type
  - Lift & Flood Combined Station

**CSO MASTER PLAN PROPOSED SOLUTIONS**

- Screening

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

**JACOBS**

Notes:
1. Map data source - City of Winnipeg, 2013

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**THE CITY OF WINNIPEG**
**WATER AND WASTE DEPARTMENT**

**FIGURE 34-01**
**Screening**
**Sewer District: River**
City of Winnipeg
*Combined Sewer Overflow Master Plan*


## LEGEND

- Critical Elevation
- CSO Outfall
- Manhole
- Sluice Gate
- Pump Location

Sewer By Type
- CS
- SRS
- WWS

Control Structure Type
- Weir Structure

Pump Station Type
- Flood Pump Station

**CSO MASTER PLAN**
**PROPOSED SOLUTIONS**

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

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Notes:
1. Map data source - City of Winnipeg, 2013

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**THE CITY OF WINNIPEG**
**WATER AND WASTE DEPARTMENT**

**FIGURE 34-02**
**Latent SRS Control**
**Sewer District: River**
City of Winnipeg
*Combined Sewer Overflow Master Plan*

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