CSO Master Plan

Jefferson East District Plan

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City of Winnipeg

CSO Master Plan

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2	08/12/2019	Final Draft Submission	DT	MF	MF
3	08/20/2019	Final Submission For CSO Master Plan	MF	MF	SG

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1. Jefferson East District

1.1 District Description

Jefferson East district is located in the northern portion of the combined sewer (CS) area and west of the Red River. This district is approximately bounded by Kingsbury Avenue to the north, McPhillips Street to the West, Carruthers Avenue and McAdam Avenue to the south, and the Red River to the east.

Jefferson East district is primarily residential including single-family land use throughout the district. Commercial areas within Jefferson East are found along the major transportation routes including Main Street and McPhillips Street. Regional transportation routes passing through Jefferson East include McPhillips Street, Main Street, Jefferson Avenue, and Inkster Boulevard. Greenspace is found scattered throughout the district. Approximately 18 ha is identified as greenspace; this includes Aster/Dahlia Park, school yards, playgrounds, and community areas.

1.2 Development

A portion of Main Street is located within the Jefferson East District. Main Street is identified as Regional Mixed Use Corridor as part of the OurWinnipeg future development plans. As such, focused intensification along Main Street is to be promoted in the future.

1.3 Existing Sewer System

The Jefferson East district has an approximate area of 445 hectares (ha)[1] based on the district boundary. There is approximately 10 percent by area (44 ha) separation ready and 45 percent by area (199 ha) where separation development is planned/underway.

The CS system includes two primary weirs, three offtake structures, a flood pump station (FPS), and an outfall gate chamber. The CS system drains towards the diversion structure and primary weir located along Jefferson Avenue immediately east of Main Street. There is also a small section of SRS pipe that runs through Jefferson East district from the Polson district along Inkster Boulevard. There are four main flow paths for the CS system to connect to the north Main interceptor. The main 2850 mm by 4270 mm CS trunk flows from the Jefferson West district along Inkster Boulevard and connects to Jefferson Avenue along Sinclair Street. This main CS trunk services the areas west of Main Street which includes the Jefferson West district; a 450 mm CS trunk flows south on Main Street, servicing a small area north on Main Street interconnecting with the Armstrong CS system; and a 300 mm CS trunk flows north on Main Street servicing a small area south on Main Street.

During dry weather flow (DWF), sanitary sewage flows into the diversion structure located at the intersection of Jefferson Avenue and Main Street upstream of the CS outfall. Note that sanitary sewage collection from the adjacent Jefferson West district is collected at this point. The sanitary sewage is diverted by the primary weir to a 1520 mm secondary interceptor pipe via a 525 mm offtake and then into the north Main Interceptor. Sewage from the areas east of Main Street during DWF is conveyed directly to the Main Interceptor without being intercepted by the primary weir. This is accomplished by either wastewater flow to the secondary interceptor on Jefferson Avenue, or via a direct connection to the Main Interceptor on Seven Oaks Avenue. The sanitary sewage from the Jefferson East and Jefferson West districts within the Main Interceptor then flows by gravity to the North End Sewage Treatment Plant (NEWPCC) for treatment.

[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.

During wet weather flow (WWF), any flows that exceed the primary weir at Jefferson Avenue and Main Street flows and is intercepted by a second primary weir at Jefferson Ave and Scotia street. This second weir is remainder from the CS arrangement in the district prior to recent sewer separation work underway. As a result of this second weir the excess CS then backs up once more within the outfall trunk. A secondary 450mm offtake is then located within this outfall trunk, near the intersection of Jefferson Avenue and Jones Street. A portion of the excess CS may then flow in this secondary offtake and may be intercepted and treated once more. The excess CS under WWF events which then spills over the second Scotia Street primary weir is discharged into the Red River by gravity. Sluice and flap gates are installed on the CS outfall to prevent river water from backing up into the CS system under high river level conditions on the Red River. Under these high river level conditions gravity discharge is not possible, and excess flow is pumped by the Jefferson FPS to an alternate outfall flow path, which allows it to by-pass the flap and sluice gates and be discharged directly to the river via the same outfall. The Jefferson outfall and adjacent Scotia Street weir however are quite low and often below the river level, which can require significant surcharge conditions to trigger an overflow event or activation of the flood pumps.

Additionally, the CS outfall may act as a high-level relief overflow for the Main Interceptor. There is a third 2280 x 1520 egg shaped offtake and diversion structure immediately west of the main 525 mm offtake pipe at Jefferson Avenue and Main Street. A flap gate is installed on this offtake, which allows surcharged flow in the Main Interceptor to flow south back into the CS system, but does not allow this offtake to divert intercepted CS into the interceptor system.

The majority of the district east of Main Street is a separation ready sewer system, as part of previous sewer separation works. Wastewater is conveyed either to the diversion structure on Jefferson Avenue and Main Street, or conveyed to a new WWS pipe on Seven Oaks Avenue which discharges directly into the Main Interceptor. The LDS system for the portion of the district east of Main Street reconnects to the Jefferson CS outfall trunk downstream of the main 525mm primary weir at two locations: along Scotia Street; at Seven Oaks Avenue, and St Anthony Avenue. Currently, with wet weather events, the land drainage flow is restricted from overflowing by the second weir located at the outfall at the intersection of Jefferson Avenue and Scotia Street. This excess land drainage flow then intercepted by the secondary 525mm offtake and is ultimately treated at the NEWPCC.

The one outfall (CS) to the Red River is as follows:

- ID33 (S-MA70007473) – Jefferson CS Outfall

1.3.1 District-to-District Interconnections

There are several district-to-district interconnections between Jefferson East and the surrounding districts. Each interconnection is shown on Figure 19 and shows locations where gravity flow can cross from one district to another. Each interconnection is listed as follows:

1.3.1.1 Interceptor Connections – Downstream of Primary Weir

Newton

- The 2250 mm Main Interceptor pipe flows north by gravity out of Jefferson East district:
  - Invert at Jefferson East district boundary 217.61 m (S-MA00017587)

1.3.1.2 Interceptor Connections – Upstream of Primary Weir

Polson

- The 2250 mm Main Interceptor flows by gravity on Main Street from Polson district into Jefferson East district:
  - Invert at Jefferson East district boundary 218.03 m (S-MA70008112)

1.3.1.3 District Interconnections

Polson

CS to CS

- High point manhole:
  - Polson Avenue – 229.11 m (S-MH00009095)
- High sewer overflow:
  - McGregor Street at Carruthers Avenue – 228.60 m (S-MH00006709)

CS to SRS

- An 1800 mm SRS relieves the main CS trunk on Polson Avenue and flows by gravity northbound on Airlies Street from Polson district to Jefferson East district. It connects with the Jefferson East CS network at the corner of Inkster Boulevard and Airlies Street before continuing onto Inkster Boulevard:
  - Invert at Jefferson East district boundary 224.01 m (S-MA00011342)

SRS to SRS

- A 2950 mm SRS flows by gravity on Inkster Boulevard from Jefferson East district into Polson district:
  - Invert at Polson district boundary 223.00 m (S-MA00008238)

Jefferson West

CS to CS

- The 2400 mm CS pipe flows by gravity east on Inkster Boulevard into Jefferson East district:
  - Inkster Boulevard at McPhillips Street – 224.53 m (S-MH00009032)
- The 450 mm CS pipe flows by gravity west on Polson Avenue into Jefferson West district:
  - Invert at Jefferson West district 225.27 m (S-MA00007321)
- The 375 mm CS pipe flows west by gravity on Lansdowne Avenue into Jefferson West district:
  - Invert at Jefferson West district boundary 227.02 m (S-MA00011271)

Armstrong

CS to CS

- The 300 mm CS pipe flows south by gravity on Powers Street from Armstrong district into Jefferson East district:
  - Invert at Jefferson East district 227.31 m (S-MA00001541)

Newton

CS to CS

- The 375 mm CS pipe flows south by gravity on Main Street into Jefferson East district:
  - Invert at Newton district boundary 226.90 m (S-MA00017220)
- The 250 mm CS pipe flows east by gravity on Kingsbury Avenue into Jefferson East district:
  - Invert at Newton district boundary 226.59 m (S-MA00017588)
- The 225 mm CS pipe flows west by gravity on Burrin Avenue into Jefferson East district:

– Invert at Newton district boundary 228.68 m (S-MA00001001)

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.

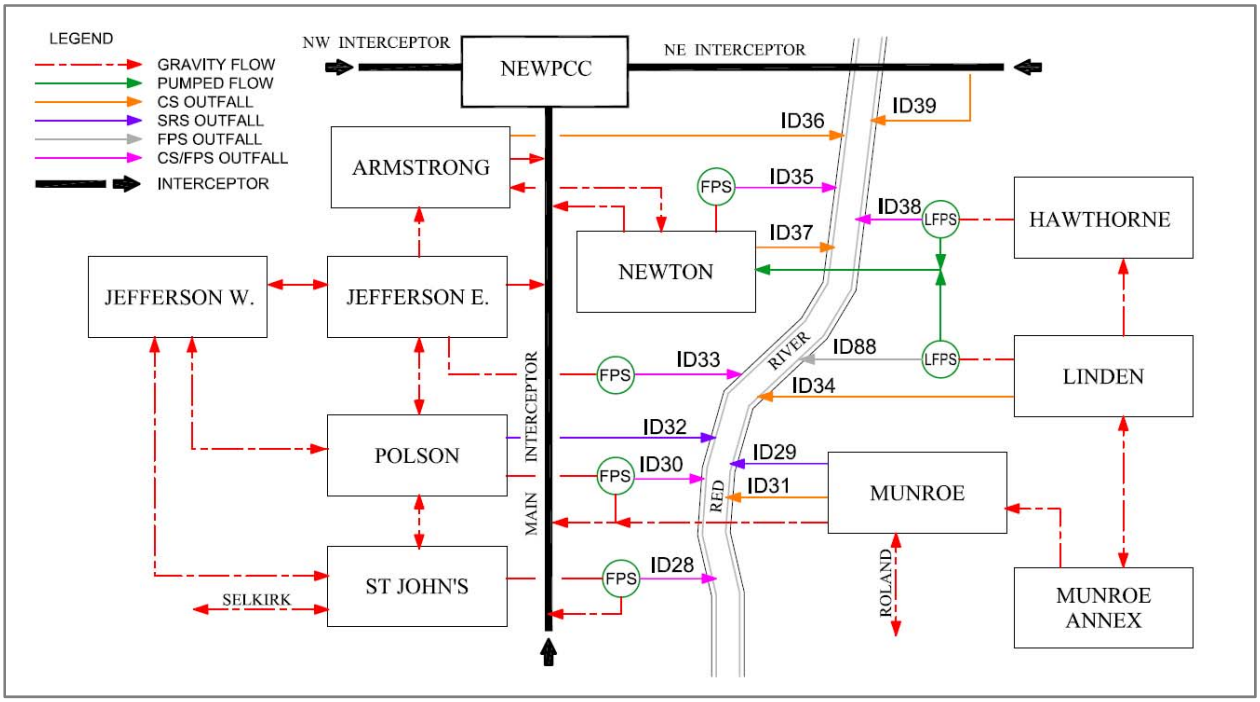


Figure 1-1. District Interconnection Schematic

1.3.2 Asset Information

The main sewer system features for the district are shown on Figure 19 and 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 (ID33)	S-TE70003093.1	S-MA70007473	3350 mm	Red River Invert: 222.88 m
Flood Pumping Outfall (ID33)	S-TE70003093.1	S-MA70007473	3350 mm	Red River Invert: 222.88 m
Other Overflows	N/A	N/A	N/A	
Main Trunk	S-MH00006000.1	S-MA00008944	2850 x 4270 mm	Egg shaped Invert: 223.16 m
SRS Outfalls	N/A	N/A	N/A	
SRS Interconnections	S-MH70015794	S-MH70015794	N/A	Combined Invert: 224.78 m
Main Trunk Flap Gate	S-AC70007929.1	S-CG00000814	3000 mm	Invert: 223.29 m Circular
Main Trunk Sluice Gate	S-AC70007969.1	S-CG00000815	3000 x 3000 mm	Invert: 223.08 m
Offtake	JEFFERSON_WEIR1.1	S-MA70017216	525 mm	Invert: 223.06 m

Table 1-1. Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
	S-TE00005277.2	S-MA70017296	1520 mm	Invert: 224.16 m
Dry Well	N/A	N/A	N/A	
Lift Station Total Capacity	N/A	S-MA70017216 (1)	525 mm (1)	0.195 m3/s (1)
ADWF	N/A	N/A	0.208 m^3/s	
Lift Station Force Main	N/A	N/A	N/A	
Flood Pump Station Total Capacity	N/A	N/A	6.85 m^3/s	3 x 1.35 m^3/s 2 x 1.4 m^3/s
Pass Forward Flow – First Overflow	N/A	N/A	1.059 m^3/s	

Notes:

(1) – Gravity pipe replacing Lift Station as Jefferson East is a gravity discharge district

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	Jefferson – 223.66
2	Trunk Invert at Offtake	223.06
3	Top of Weir	Weir at FPS: 223.75
4	Relief Outfall Invert at Flap Gate	N/A
5	Low Relief Interconnection (S-MH70015794)	Invert – 224.78
6	Sewer District Interconnection (Polson)	223.00
7	Low Basement	226.47
8	Flood Protection Level (Jefferson East)	228.92

[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 Jefferson East was the *Jefferson Combined Sewer Districts Sewer Relief and CSO Abatement Study* (AECOM Canada Ltd, 2009). The study's purpose was to determine the most cost-effective means to upgrade the hydraulic capacity of the combined sewer system to reduce basement flooding during extreme rainfall events. Works ongoing now include implementation of many of the recommendations of this 2009 study.

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 Jefferson East 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.

From 2012 to 2016, the Jefferson East Sewer Relief project work has been completed within the majority of the area to the east of Main Street, to align with the 2009 AECOM study. Four separation construction contracts have been completed during this time with a construction cost of approximately $11.5 Million spent to date.

- The Jefferson East Relief Sewer Contracts 1 to 3 involved the installation of LDS pipes to collect runoff from the catch basins within the majority of the area (Kilbride Avenue still to be separated).
    - The LDS system reconnects to the existing CS system at two locations along Scotia Street; at Seven Oaks Avenue and St Anthony Avenue.
    - At each reconnection point, a new WWS pipe diverts wastewater flows from the existing CS system immediately upstream of both locations, these flow into the new WWS pipes to connect to the Main Interceptor pipe.
- Contract 4 involved the construction of a new LDS gate chamber and 2100 mm diameter outfall pipe.
    - The outfall pipe and gate chamber is located within the adjacent Newton district and on the City land near Scotia Street and Semple Avenue, within the Newton district.
    - It is proposed that the new LDS system will connect to the new LDS gate chamber within future contracts.

Table 1-3. District Status

District	Most Recent Study	Flow Monitoring	Hydraulic Model	Status	Planned Completion
19 – Jefferson E	2009	Future Work – Following Sewer Separation	2013	Construction Underway	TBD

1.5 Ongoing Investment Work

As part of the Jefferson East Sewer Relief work, a further six Contracts are planned (AECOM Canada Ltd, 2009). The six Contracts are estimated to cost approximately $35 Million (AACE Class 3, 2011 estimate). This work includes sewer separation of the area between Main Street and the C.P.R. Winnipeg Beach Rail Line (i.e. east of rail line). This work has been recommended as part of the solutions to meet Control Option 1 for this district (see Section 1.6).

The City has also developed a conceptual sewer separation plan for the area west of the Winnipeg Beach Rail Line (201 ha). The sewer separation work in this part of the district is estimated to cost $45 Million (AACE Class 3, 2011 estimate). The City however has not committed to having this work west of the rail line completed, and it has not been recommended as part of the solutions to meet Control Option 1.

The City is also currently investigating multiple items of work to improve the performance of this district. These have been summarized below:

- The potential to remove the second Scotia Street weir just upstream of the FPS. The recent sewer separation work allows all wastewater flows to be diverted out of this section of the CS system. Therefore, the existing weir is only holding back LDS flow and excess CS during WWF events at present. The weir located at the primary diversion adjacent to the main 525mm offtake will then be treated as the new critical overflow location.
- Due to the Jefferson outfall being very low, the river level is often higher than the current weir, and to keep the Jefferson outfall drained the secondary 450mm offtake is left open. This however also results in the unnecessary collection and treatment of land drainage flow backed up by the second Scotia Street. As a result, the closure of the secondary diversion 450mm offtake on Jefferson Avenue is also to be investigated.

- The proposed work identified in the points above would result in the requirement for a portion of the existing permanent CSO instrumentation to be relocated. New instrumentation upstream and downstream of the new primary diversion weir would need to be installed.
- The flood pumping arrangements are under review by the City, so that the closure of the secondary offtake mentioned above can be evaluated. The aim would be for the FPS to be reclassified as a land drainage flood pumping station as this would more accurately reflect the upstream system. Any CSO overflow volume would have to be modelled, estimated, and verified based on the new instrumentation at the new primary weir and not the outfall in order to separate the portion of CS and LDS flow.
- The primary 525mm offtake is potentially undersized and should also be reviewed as part of the work tasks listed above. The completion of the reminder of the partial sewer separation work planned in the district may result in a sufficient reduction in the wet weather response from the district such that this offtake is appropriately sized.

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

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 Jefferson East sewer district are listed in Table 1-4. The proposed CSO control projects will include partial sewer separation, in-line storage via control gate, and floatables management via screening. 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

Jefferson East has been identified for partial sewer separation. This work is underway and will continue as part of the CSO Master Plan. The potential for stepped sewer separation of the remainder of the district was also investigated, but found that more cost effective measures such as in-line storage could achieve the remaining volume capture required from the district. As the remainder of the district is not currently prioritized for separation as part of the BFR program, it has not be recommended as part of the CSO Master Plan.

A gravity flow controller is proposed on the CS system to optimize and monitor the dewatering rate from the district back into the Main Interceptor. A second controller is not proposed for the new Seven Oaks Avenue WWS direct connection to the Main Interceptor, due to the relatively small catchment area.

The existing CS system is suitable for use as in-line storage. This control option will take advantage of the existing CS system for additional storage volume. The Jefferson East district has a large volume of potential in-line storage capacity due in part to the interconnection with upstream Jefferson West district and the large diameter pipes conveying flows from West to East.

Floatable control will be necessary to capture any undesirable 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. Screens will be on the primary CS outfall near the intersection of Jefferson Avenue and Scotia street.

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.

1.6.2 Sewer Separation

Partial sewer separation is currently underway for the Jefferson East district and is proposed to continue as part of the CSO Master Plan. Sewer separation will free up capacity in the CS trunk and reduce the overflows from this district. A subsequent impact is that the additional capacity can then be utilized as storage in the form of in-line storage to help balance flow to the Main Street interceptor, and ultimately to the NEWPCC.

The area east of Main Street has undergone LDS separation work including installation of a separate LDS system to collect overland drainage. At present, the new LDS collects flows from area between Main Street and Scotia Avenue from Smithfield Avenue to Hartford Avenue. A new LDS outfall was constructed on Scotia Avenue and will be connected to the new LDS in the future. . Continued LDS separation work is proposed up to the C.P.R. Winnipeg Beach Rail Line that divides the district. This will reduce overall flow to the outfall and reduce CSOs. Partial sewer separation will also increase the available capacity for in-line storage and would reduce the sewage flow being diverted at the primary weir.

1.6.3 In-Line Storage

In-line storage has been proposed as a CSO control for Jefferson East district. The in-line storage will require the installation of a control gate at the CS outfall. The gate will increase the storage level in the existing CS to provide an overall higher volume capture. The control gate will provide a secondary benefit by increasing the hydraulic head necessary for screening operations. Note that the flows from the upstream Jefferson West district also discharges directly to the Jefferson East district, and will be additionally captured by this in-line storage arrangement.

It should be noted that due to only partial separation being completed in the Jefferson East district, in combination with the Jefferson West combined district also discharging into this district, that the in-line storage measures are being recommended. If complete separation was pursued for the remainder of this district and for the Jefferson West district, this recommendation would no longer be required.

A standard design was assumed for the control gate, as described in Part 3C. A standard approach was used for conceptual gate sizing by assuming it to be the lesser of the height of half of the site-specific trunk diameter or the maximum height of the gate available. The design criteria for in-line storage are listed in Table 1-5.

Table 1-5. In-Line Storage Conceptual Design Criteria

Item	Elevation/Dimension	Comment
Invert Elevation	223.16 m	
Trunk Diameter	2850 x 4270 mm	
Gate Height	1.47 m	Gate height based on half trunk diameter assumption

Table 1-5. In-Line Storage Conceptual Design Criteria

Item	Elevation/Dimension	Comment
Top of Gate Elevation	225.22 m	
Maximum Storage Volume	12335 m^3	
Nominal Dewatering Rate	0.195 m^3/s	Based on pipe pass forward flow at Jefferson diversion chamber
RTC Operational Rate	TBD	Future RTC / dewatering review on performance

Note:
TBD = to be determined

RTC – Real Time Control

The control gate will cause combined sewage to back-up within the collection system to the extent shown on Figure 19. The extent of the in-line storage and volume is related to the top elevation of the gate. The level of the top of the bypass side weir and adjacent control gate level are determined in relation to the critical performance levels in the system for basement flooding protection. When the system level increases above the bypass weir crest and proceeds above the top of the control gate during high flow events, the gate drops out of the way. At this point, the district will only provide its original interception capacity via the primary weir for the district, and all excess CS would flow over the weir and eventually discharge to the river. After the sewer levels in the system drops back below the bypass side weir critical performance level, the control gate moves back to its original position to capture the receding limb of the WWF event. The existing DWF diversion rate will continue with its current operation, with all DWF being diverted to the Main Interceptor. The area east of Main Street within the Jefferson East district will continue to divert into the Main Interceptor via the Seven Oaks Avenue WWS pipe.

Figure 19-01 provides an overview of the conceptual location and configuration of the control gate, bypass weir and screening chambers. The proposed control gate will be installed in a new chamber within the trunk sewer alignment. The dimensions of a new chamber to provide an allowance for a side weir for floatables control are 6 m in length and 4.5 m in width. The existing diversion chamber and weir may be impacted by the construction of the chambers and require some reconfiguration. The physical requirements for a modification to existing diversion chamber have not been considered in detail, but they will be required in the future as part of removal of the secondary offtake that the City is currently investigating. The removal of this secondary offtake would allow more space for these chambers. The physical location will cause disruptions due to being located adjacent to a main road interception (Jefferson Avenue and Main Street) and potential to move further away from the interconnection would be considered in the next stage.

The nominal rate for dewatering is determined by the performance of the existing pipe capacity as the district is a gravity discharge district. As such the flows will vary over the duration of a rainfall event and has been nominated for a gravity flow control device. Any future consideration, for RTC improvements, would be completed with spatial rainfall as any reduction to the existing pipe capacity/operation for large events will adversely affect the overflow at this district. The control device would be set to a rate similar to the existing pipe full capacity to allow the set limit to be known. This would allow the future RTC to control the ability to capture and treat more volume for localized storms in other districts by using the excess interceptor capacity made available by restricting the pass forward flows through the control device where the runoff is less.

1.6.4 Gravity Flow Control

Jefferson East district does not include a LS and discharges to the Main Interceptor by gravity. A flow control device will be required to control the diversion rate at the main diversion pipe on Jefferson Avenue for future RTC.. The flow controller will include flow measurement and a gate to control the discharge flow rate. A standard flow control device was selected as described in Part 3C. The small contributing area

associated with the second WWS pipe directly connecting to the Main Interceptor sewer from Seven Oaks Avenue will not require a flow controller.

It should be noted that due to only partial separation being completed in the Jefferson East district, in combination with the Jefferson West combined district also discharging into this district, that gravity flow control is still required. If complete separation was pursued for the remainder of this district and for the Jefferson West district, this recommendation would no longer be required.

The flow control would be installed at an optimal location on the connecting sewer between the proposed in-line control and existing diversion chamber. A small chamber or manhole with access for cleaning and maintenance will be required. The flow controller will operate independently and require minimal operation interaction.

A gravity flow controller has been included as a consideration in developing a fully optimized CS system as part of the City's long-term objectives. The operation and configuration of the gravity flow controller will have to be further reviewed for additional flow and rainfall scenarios.

1.6.5 Floatables Management

Floatables management will require installation of a screening system to capture floatable materials from the Jefferson East district. The off-line screens would be proposed to maintain the current level of basement flooding protection.

It should be noted that due to only partial separation being completed in the Jefferson East district, in combination with the Jefferson West combined district also discharging into this district, that floatables management of CSO events is still required. If complete separation was pursued for the remainder of this district and for the Jefferson West district, this recommendation would no longer be required.

The type and size of screens depend on the hydraulic head available for operation. A generic design was assumed for screening and is described in Part 3C. The design criteria for screening with gate control implemented, are listed in Table 1-6.

Table 1-6. Floatables Management Conceptual Design Criteria

Item	Elevation/Dimension/Rate	Comment
Top of Gate	225.22 m	
Bypass Weir Crest	225.12 m	
NSWL	223.66 m	
Maximum Screen Head	1.455 m	
Peak Screening Rate	0.89 m^3/s	
Screen Size	1.5 m wide x 1 m high	Modelled Screen Size

The proposed bypass side overflow weir and screening chamber will be located adjacent to the existing combined trunk sewer, as shown on Figure 19-01. The screens will operate once levels within the sewer surpassed the in-line control elevation. A bypass side weir upstream of the gate will direct the initial overflow to the screens located in the new screening chamber, with screened flow discharged to the downstream side of the gate to the river. The screening chamber may include screenings pumps with a discharge returning the screened material back to the interceptor and on to the NEWPCC for removal. The provision of screening pumps is dependent on final level assessment within the existing infrastructure and the Jefferson trunk has potential for gravity screening return to occur. This would be confirmed during the future assessment stage.

The dimensions for the screen chamber to accommodate influent from the side weir, the screen area, and the routing of discharge downstream of the gate are 4 m in length and 3.5 m in width. The impact of this chamber was defined in the in-line storage section.

1.6.6 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 will be reviewed to identify applicable GI controls.

Jefferson East has been classified as a medium GI potential district. Jefferson East district is primarily residential including single-family land use throughout the district. Commercial areas within Jefferson East are found along the major transportation routes including Main Street and McPhillips Street. This means the district would be an ideal location for bioswales, permeable paved roadways, cisterns/rain barrels, and rain gardens. There are a few flat roof commercial buildings in the district which make an ideal location for green roofs.

1.6.7 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.

Sewer separation will include the installation of additional sewers that will require inspection, cleaning and rehabilitation. This will result in additional maintenance costs over the long term, but operational costs will be minimal. The existing larger CS pipes within the district may also receive insufficient flows with the separation work for proper scouring velocities in the sewer pipes. This could result in solids settling within the sewers and requiring more frequent cleaning operations. The impacts of the reduced flows in larger CS pipes will be evaluated as part of the sewer separation design for the districts.

In-line storage will impact the existing sewer and will require the addition of a new chamber and a moving gate at the outfall. In-line storage dewatering will be controlled with the existing Clifton CS LS, which will require more frequent and longer duration pump run times. Lower velocities will occur in the CS trunk in the vicinity of the control gate due to lower pass forward flows, and may create additional debris deposition requiring cleaning. Additional system monitoring, and level controls will be installed, which will require regular scheduled maintenance.

The flow controller will require the installation of a chamber and flow control equipment. Monitoring and control instrumentation will be required. The flow controller will operate independently and require minimal operation interaction. Regular maintenance of the flow controller chamber and appurtenances will be required.

Floatable control with outfall screening will require the addition of another chamber with screening equipment installed. The chamber will be installed adjacent to the control gate chamber and will operate in conjunction with it. Screening operation will occur during WWF events that surpass the in-line storage control level. WWF will be directed from the main CS trunk, over the side weir in the control gate chamber and through the screens to discharge into the river. 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 will correlate to the number overflows identified for the district. Having the screenings

pumped back to the interceptor system via a small LS and force main will be required. The screenings return will require O&M inspection after each event to assess the performance of the return pump system.

1.8 Performance Estimate

An InfoWorks CS hydraulic model was created as part of the CSO Master Plan development. An individual model was created to represent the sewer system baseline as represented in the year 2013 and a model for the CSO Master Plan with the control options implemented in the year 2037. A summary of relevant model data is summarized in Table 1-7.

Table 1-7. InfoWorks CS District Model Data

Model Version	Total Area (ha)	Contributing Area (ha)	Population	% Impervious	Control Options Added To Model
2013 Baseline	444	444	13,614	59	N/A
2037 Master Plan – Control Option 1	444	250	13,614	59	IS, SC, SEP

Notes:

IS = In-line Storage
SC = Screening
SEP = Sewer Separation

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 for Control Option 1 as shown in Table 1-8 are based on the hydraulic model simulations using the year-round 1992 representative year applied uniformly. The 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. The table also includes overflow volumes specific to each individual control option when simulation were completed: these are listed to provide an indication of benefit gained only and are independent volume reductions unless noted otherwise.

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

Control Option	Preliminary Proposal	Master Plan			
	Annual Overflow Volume (m^3)	Annual Overflow Volume (m^3)	Overflow Reduction (m^3)	Number of Overflows	Pass Forward Flow at First Overflow [b]
Baseline (2013)	274,354	287,466	-	20	0.730 m^3/s
In-Line Storage	89,720 [a]	101,217	186,249	18	0.730 m^3/s
In-line Storage & Partial Sewer Separation		47,252	53,965	11	1.059 m^3/s
Offline Storage, Partial Separation & In-line Storage	48	N/A [c]	N/A [c]	N/A [c]	N/A [c]
Control Option 1	**48**	**47,252**	**240,214**	**11**	**1.059 m^3/s**

[a] Partial Separation and In-line Storage were not simulated independently during the Preliminary Proposal assessment.
[b] Pass forward flows assessed on the 1-year design rainfall event
[c] Off-line storage solution proposed during Preliminary Proposal, but not carried forward as part of Master Plan recommendations.

The control options proposed for the CSO Master Plan were based on the more focused district assessment and provision to achieve the system-wide 85 percent capture target. The off-line storage facility was not necessary to achieve this percent capture target and a stepped approach for the provision of sewer separation was assessed to be a more cost-effective approach for Control Option No.1. 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 a Class 5 planning level estimates with a level of accuracy of minus 50 percent to plus 100 percent.

Table 1-9. District Cost Estimate – Control Option 1

Control Option	2014 Preliminary Proposal Capital Cost	2019 Master Plan Capital Cost	2019 Annual Operations and Maintenance Cost	2019 Total Operations and Maintenance Cost (Over 35-year period)
Separation	- [a]	$145,510,000	$87,000	$1,860,000
Screening	$7,740,000 [b]	$2,890,000 [f]	$33,000	$710,000
In-Line Storage Control Gate		$3,130,000	$44,000	$940,000
Gravity Flow Control	N/A [d]	$1,280,000	$34,000	$740,000
Off-line Storage	$25,820,000 [c]	N/A [e]	N/A [e]	N/A [e]
Subtotal	**$33,560,00**	**$152,810,000**	$198,000	**$4,250,000**
Opportunities	N/A	$15,280,000	$20,000	$430,000
District Total	**$33,560,00**	**$168,090,000**	$218,000	**$4,680,000**

[a] Separation cost not included in Preliminary Proposal. Solution developed as refinement to Preliminary Proposal costs. Costs for the partial separation item of work found to be $101,700,000 in 2014 dollars.
[b] Screening and In-Line Storage Control Gate cost combined in the Preliminary Proposal cost estimates.
[c] Solution was refined following initial Preliminary Proposal cost submission of $25,820,000. Updated costs for this item of work estimated at $67,550,000 in 2014 dollars.
[d] Gravity Flow Control recommendation developed as part of Master Plan, and was not part of the Preliminary Proposal.
[e] Off-line storage solution proposed during Preliminary Proposal, but not carried forward as part of Master Plan recommendations.
[f] Cost for bespoke screenings return pump 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 costs 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 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 alternative plans, 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	In-line Storage Control Gate	Preliminary estimate was based on a standard cost per district, which has been updated to a site-specific cost estimate.	The change may result in significant changes to individual districts but balances out over the entire CS area.
	Screening	Preliminary estimate was based on a standard cost per district, which has been updated to a site-specific cost estimate.	The change may result in significant changes to individual districts but balances out over the entire CS area.
	Removal Of Off-line Storage	Not included in the Master Plan	Removed through marginal analysis
	Separation	Not included in Preliminary Proposal Estimate	
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 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, a future performance target of 98 percent capture for the representative year measured on a system-wide basis was evaluated. 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 No.1.

Overall the Jefferson East district would be classified with medium potential for implementation of complete sewer separation as the only feasible approach to achieve the 98 percent capture in the representative year future performance target. The cost comparison indicated that due to the potential storage capacity within the existing system, in-line storage would be a cost-effective interim solution. However, if the planned sewer separation of the remainder of the Jefferson East district was pursued, there would no longer be the requirement the in-line storage to be constructed. At this point the separation of the remaining Jefferson West district would need to be completed before the solutions recommended to meet Control Option 1 would not be required.

If complete separation is not pursued, green infrastructure and off-line tank or tunnel storage may be utilized in key locations to provide additional storage and increase capture volume to meet future performance targets.

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	• Separation of remaining Jefferson East district • Increase use of GI • Off-line storage facilities

The control options selected for the Jefferson East district have been aligned with the City's Basement Flood Relief program that was ongoing prior to the development of the CSO Master Plan. The 85 percent capture performance target is achieved on a system wide basis and the interactions with the adjacent districts (Jefferson West discharges directly to Jefferson East) did not require sewer separation of the entire Jefferson East district. As a result, the construction of a control gate and screening facility are still required for floatables management. The gate and screening installation would restrict the expandability of the control arrangement in this district. Reduced expandability may limit the district's contribution towards achieving the 98 percent capture performance target if not assessed on a system wide basis.

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 part of Appendix D in Part 3B. The identification of the most significant risks and opportunities relevant to this district are provided in Table 1-12.

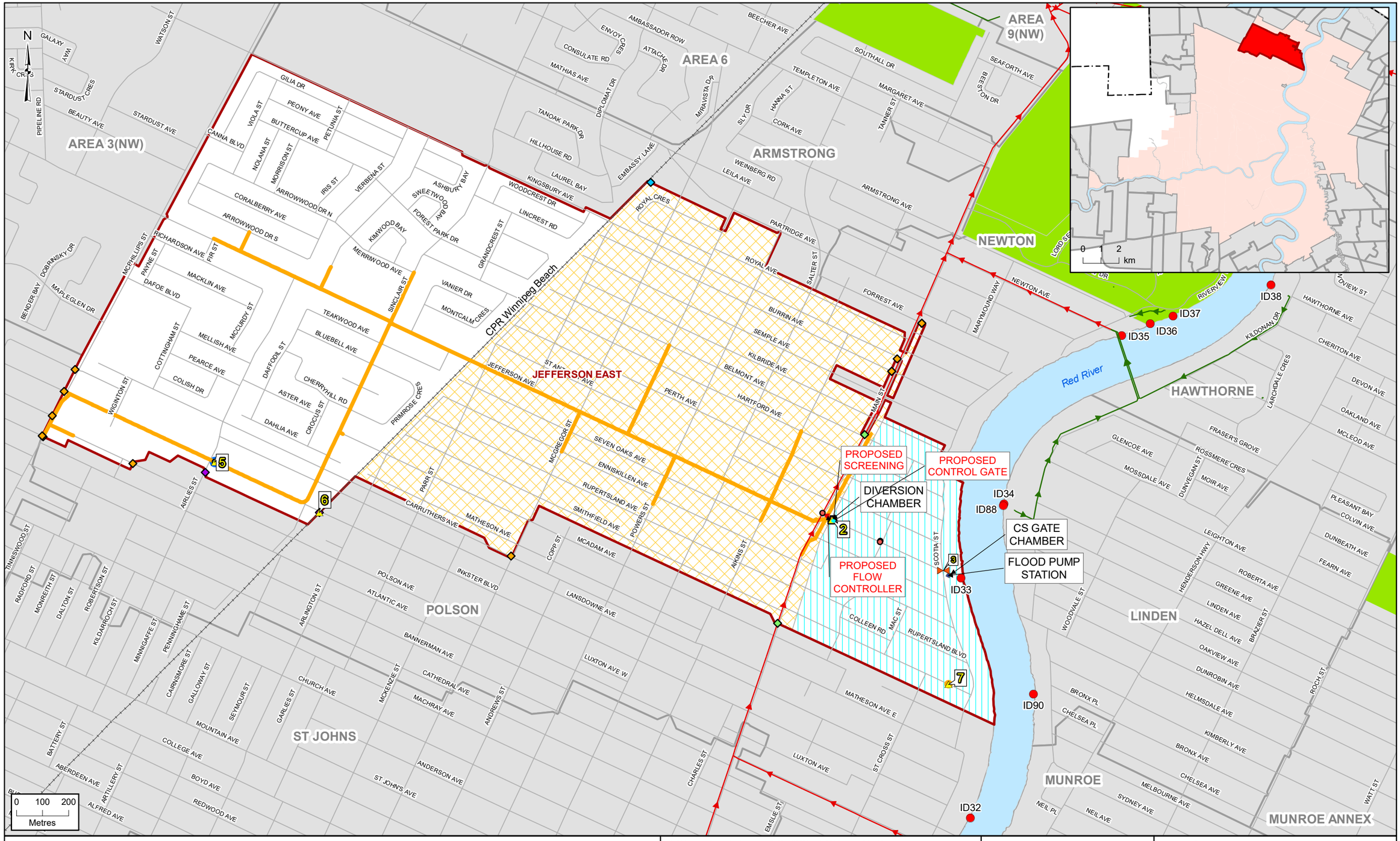
Table 1-12. Control Option 1 Significant Risks and Opportunities

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	-	-	O	-	-	-
2	Existing Lift Station	-	R	-	-	-	-	R	-
3	Flood Pumping Station	-	-	-	-	O	-	-	-
4	Construction Disruption	-	-	-	-	R	-	-	-
5	Implementation Schedule	-	-	-	-	R	-	R	-
6	Sewer Condition	-	R	-	-	-	-	-	-
7	Sewer Conflicts	-	R	-	-	R	-	-	-
8	Program Cost	-	O	-	-	R	-	-	O
9	Approvals and Permits	-	-	-	-	-	R	-	-
10	Land Acquisition	-	-	-	-	-	R	-	-
11	Technology Assumptions	-	-	-	-	O	O	O	-
12	Operations and Maintenance	-	R	-	-	R / O	R	O	R
13	Volume Capture Performance	-	O	-	-	-	O	O	-
14	Treatment	-	R	-	-	O	O	O	R

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

1.12 References

AECOM Canada Ltd. 2009. *Jefferson Combined Sewer Districts Sewer Relief and CSO Abatement Study.* Prepared for the City of Winnipeg, Waterworks, Waster and Disposal Department. March.



LEGEND

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

District Boundary Crossing
- CS
- LDS
- SRS
- WWS

- Interceptor Sewer
- Force Main
- Street
- Railway

- District Boundary
- Watercourse
- Greenspace

CSO MASTER PLAN PROPOSED SOLUTIONS

- Proposed Control Gate
- Extent of In-line Storage
- Sewer Separation - Underway
- Sewer Separation - Complete

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

JACOBS

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

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

FIGURE 19
District Overview Map
Sewer District: Jefferson East
City of Winnipeg
Combined Sewer Overflow Master Plan

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LEGEND

- Critical Elevation
- Manhole
- Flap Gate

Sewer By Type
- CS
- WWS

Pump Station Type
- Diversion Chamber

CSO MASTER PLAN
PROPOSED SOLUTIONS
- Control Gate
- Screening
- Flow Controller

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

JACOBS

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

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

FIGURE 19-02
Flow Controller
Sewer District: Jefferson East
City of Winnipeg
Combined Sewer Overflow Master Plan

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