CSO Master Plan

Clifton District Plan

August 2019

City of Winnipeg

CSO Master Plan

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1	02/15/2019	DRAFT 2 for City Review	SB	SG	MF
2	07/2019	Final Draft Submission	DT	MF	MF
3	08/16/2019	Final Submission For CSO Master Plan	MF	MF	SG

Contents

Tables

Figure

1. Clifton District

1.1 District Description

Clifton district is located towards the western edge of the combined sewer (CS) area. It stretches from Pacific Avenue West at the north to the Assiniboine River at the south. The most northern section of Clifton is split by Aubrey district. This section is bounded by Keewatin Street to the west, Pacific Avenue West to the north, Weston Street to the east, and Notre Dame Avenue to the south. The southern section of Clifton is bounded by the Midland Rail line to the west; Saskatchewan Avenue to the north; Downing, Goulding, and Clifton Streets to the east; and the Assiniboine River to the south. Omand's Creek runs north-south along the western side of the district boundary adjacent to theTylehurst district and extends from Dublin Avenue to the Assiniboine River.

Many major transportation routes pass through the district. Ellice Avenue, Wellington Avenue, Sargent Avenue, Notre Dame Avenue, and Portage Avenue run horizontally through Clifton providing a corridor for small commercial businesses. Wall Street and Erin Street run parallel to each other providing access from Portage Avenue to Notre Dame Avenue. Clifton district also includes two rail lines:

- Canadian Pacific Railway (CPR) Lariviere
- CPR Spur SJ Industry

The Clifton area is primarily residential and industrial with an even distribution of general, light, and heavy manufacturing facilities located in the northern section of Clifton and along Erin and Wall Streets. Residential areas are located throughout the district and include mostly single- and two-family homes with a few apartment buildings. Approximately 30 ha of the district is classified as greenspace.

1.2 Development

A portion of Portage Avenue is located within the Clifton District. Portage Avenue is identified as a Regional Mixed Use Corridor as part of the OurWinnipeg future development plans. As such, focused intensification along Portage Avenue is to be promoted in the future.

1.3 Existing Sewer System

Clifton district encompasses an area of 371 ha[1] and includes both a CS system and a storm relief sewer (SRS) system. As shown in Figure 08, there is no LDS already separated areas and 2 percent (7 ha) of the total district is considered separation ready.

The Clifton sewer system includes a flood pump station (FPS), CS lift station (LS), and a CS outfall gate chamber located adjacent to the Assiniboine River at Clifton Street and Wolseley Avenue. The sewage LS is located beside the flood pumping station (FPS) with an independent outfall to the river.

CS flows south through a 2970 by 2300 mm main egg-shaped trunk sewer that runs along Clifton Street. A 600 mm collector pipe collects sewage from four residential blocks south of Portage Avenue and ties into the Clifton trunk sewer immediately upstream of the Clifton CS outfall. CS from the northern section of Clifton district flows through the 1025 by 1325 mm egg-shaped trunk on Clifton Street and flows south towards the CS outfall. There is an extensive SRS pipe network in both the northern and southern sections of Clifton. The majority of these SRS pipes drain towards a dedicated SRS outfall at the southern end of Strathcona Street.

[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 dry weather flow (DWF), the SRS is not utilized, and all sanitary sewage is diverted by the primary weir through the 500 mm off-take pipe to the Clifton CS LS, where it is pumped to the Portage interceptor pipe where it flows by gravity east along Wolseley Avenue and on to 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 then overtops the weir and is discharged to the river. Sluice and flap gates are installed on the Clifton CS outfall and are utilized to restrict back-up from the Assiniboine River into the CS system during high river level conditions. When the Assiniboine River level is high like this however gravity discharge is not possible due to the flap gate. The excess flow under these conditions is instead pumped by the Clifton FPS to discharge into a dedicated FPS outfall. There are no flap or sluice gates installed on this FPS outfall, and allows for gravity discharge to the river regardless of river level conditions.

During WWF as well, the SRS system provides relief to the CS system in the Clifton district by diverting CS into the SRS system via high point overflow connections between the CS and SRS systems. Portions of this SRS divert CS from the CS system at one point, but then ties back into the CS system at a point further downstream. The majority of SRS for the Clifton district flow by gravity to a dedicated SRS outfall on Strathcona Street. Flap and positive gates are installed on the Strathcona SRS outfall pipe to prevent river water from backing up into the Clifton SRS under river level conditions. The Strathcona SRS outfall discharges into Omand's Creek.

The outfalls to for the Clifton District are as follows:

- ID54 (S-MA70008731) – Clifton CS Outfall
- ID81 (S-MA70042741) – Clifton FPS Outfall
- ID72 (S-MA20011477) – Clifton SRS Outfall

1.3.1 District-to-District Interconnections

There are several district-to-district interconnections between Clifton and the surrounding districts. Each interconnection is shown on Figure 08 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

Aubrey

- A 1200 mm WWS Main interceptor flows eastbound by gravity at the district boundary between Clifton and Aubrey and on to the North End Sewage Treatment Plant (NEWPCC) for treatment:
  - Invert at manhole on Wolseley Avenue at Clifton district boundary – 226.69 m (S-MA70017830)

1.3.1.2 Interceptor Connections – Upstream of Primary Weir

Tylehurst

- A 600 mm WWS Main interceptor flows eastbound by gravity through the siphon at the district boundary between Clifton and Tylehurst and on to the North End Sewage Treatment Plant (NEWPCC) for treatment:
  - Invert at manhole on Portage Avenue at Clifton district boundary – 228.11 m (S-MH20009684)

1.3.1.3 District Interconnections

Tylehurst

<u>CS to CS</u>

- A 200 mm CS sewer from Tylehurst district into the Clifton CS system:
  - Sargent Avenue and Sanford Street – 228.92 m (S-MH20009103)

Aubrey

CS to CS

- High Point Manhole:
  - Midland Street – 230.72 m (S-MH20010625)
  - Notre Dame Street – 230.28 m (S-MH20010674)
  - Wall Street (near Wall Street East) – 229.04 m (S-MH20009426) (also to SRS)
  - Wolseley Avenue – 230.22 m (S-MH70039558)
  - Pacific Avenue West and Quelch Street – 228.87 m (S-MH20011789)
  - Alexander Avenue and Quelch Street – 228.57 m (S-MH20010968)
  - Portage Avenue and Clifton Street – 227.24 m (S-MH20010003)
- A 750 mm pipe directs excess flow from the Clifton district to the Aubrey district at the intersection of Roy Avenue and Cecil Street:
  - Cecil Street – 227.88 m (S-MH20010899)
- A 750 mm bifurcation pipe from Aubrey flows southbound on Quelch Street and excess flows connect to the CS system south in the Clifton district on Logan Avenue:
  - Logan Avenue – 227.03 m (S-MH20010965)

CS to SRS

- High Point Manholes:
  - Minto Street – 227.56 m (S-MH20008769)
  - Goulding Street – 229.9 m (S-MH20008710)
  - Goulding Street – 229.53 m (S-MH20008700)
  - Wolseley Avenue and Basswood Place – 229.65 m (S-MH70005332)
- A 450 mm SRS overflow pipe connects from the Aubrey district to the SRS system in Clifton district at Keewatin Street and Alexander Avenue:
  - Alexander Avenue – 228.27 m (S-MH20011401)
- A 300 mm SRS overflow pipe connects into the SRS system in Clifton district to reduce sewage back-up of the CS network in Aubrey on Pacific Avenue West:
  - Pacific Avenue West – 227.84 m (S-MH20011392)
- A 300 mm diversion pipe provides relief to the CS on Sprague Street and flows from a high point manhole into the Clifton district flowing eastbound on Wolseley Avenue:
  - Wolseley Avenue – 229.42 m (S-MH20010522)

SRS to SRS

- A 2700 mm SRS trunk conveys flow by gravity southbound on Midland Street from Aubrey district into Clifton district to Clifton's SRS outfall:
  - Midland Street – 225.53 m (S-TE20003059)

- A 2250 mm SRS trunk flows by gravity from northern Clifton into Aubrey district at the intersection of Notre Dame Avenue and Flint Street. It also connects to a SRS coming eastbound from Aubrey and then it connects to the SRS that flows south on Midland Street:
  - Flint Street and Notre Dame Avenue – 225.68 m (S-MH20011539)
- A 1650 mm SRS flows by gravity from northern Clifton collecting overflow from the CS system, into Aubrey district on Notre Dame Avenue. It then connects the SRS that flows south on Midland Street:
  - Notre Dame Avenue – 227.22 m (S-MH20010742)
- A 1350 mm SRS flows by gravity from the Aubrey district into Clifton district along Quelch Street at Logan Avenue:
  - Logan Avenue – 226.91 m (S-MH20010964)
- A 1350 mm SRS pipe flows by gravity from the Aubrey district into Clifton along Worth Street:
  - Worth Street – 226.94 m (S-TE20003936)

<u>SRS to CS</u>

- A 600 mm SRS overflow pipe from Aubrey's CS system flows into Clifton district on Notre Dame Avenue near Clifton Street North:
  - Notre Dame Avenue – 228.5 m (S-MH20011679)
- A 375 mm SRS overflow pipe from Aubrey's CS system flows into Clifton district on Logan Avenue near Wiens Street and connects to the SRS along Logan Avenue:
  - Logan Avenue – 228.83 m (S-MH20011446)

<u>WWS to CS</u>

- A 250 mm WWS pipe flows westbound from the Aubrey district on Pacific Avenue into the Clifton CS system:
  - Pacific Avenue – 227.92 m (S-MH20011757)

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.

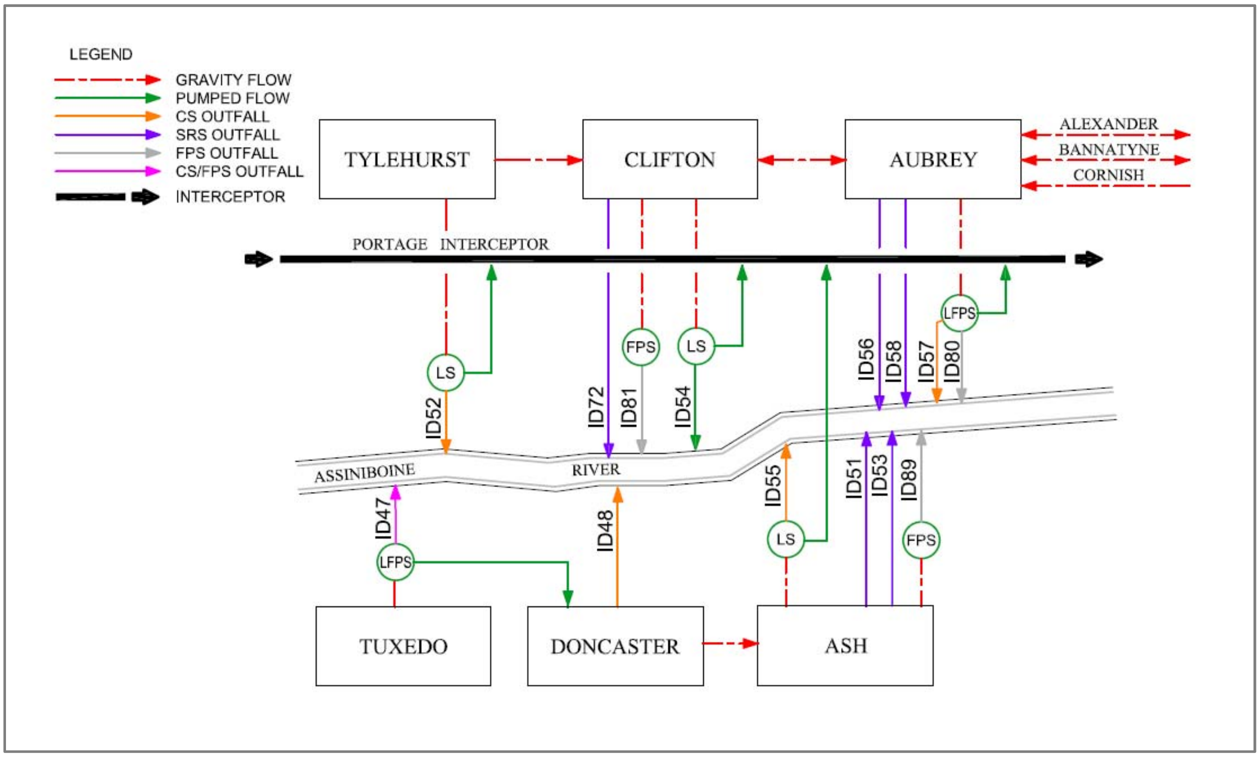


Figure 1-1. District Interconnection Schematic

1.3.2 Asset Information

The main sewer system features for the district are shown on Figure 08 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 (ID54)	CLIFTON_GC2.1	S-MA70008731	2500 mm	Circular Invert: 223.50 m
Flood Pumping Outfall (ID81)	S-AC70016634.1	S-MA70042741	2100 mm	Circular Invert: 224.75 m
Other Overflows	N/A	N/A	N/A	
Main Trunk	S-CG00000937.1	S-MA70008732	2970 x 2300 mm	Egg-shaped Invert: 223.82 m
SRS Outfalls (ID72)	S-MH70004527.1	S-MA20011477	2700	Circular Invert: 223.68 m
SRS Interconnections	N/A	N/A	N/A	60 SRS-CS
Main Trunk Flap Gate	CLIFTON_WEIR.1	S-CG00000762	2100 mm	Invert: 224.05 m
Main Trunk Sluice Gate	CLIFTON_GC1.1	S-CG00000763	1800 x 2400 mm	Invert: 224.03 m
Off-Take	S-TE70008194.1	S-MA70017712	500 mm	Circular Invert: 223.80 m
Dry Well	N/A	N/A	N/A	
Lift Station Total Capacity	N/A	N/A	0.250 m^3/s	1 x 0.150 m^3/s 1 x 0.100 m^3/s
Lift Station ADWF	N/A	N/A	0.066 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-AC70008191.1	S-MA70017710	300 mm	Invert: 226.65 m (Note downstream gravity Interceptor 1066 mm diameter with peak flow capacity of 0.791 m^3/s)
Flood Pump Station Total Capacity	N/A	N/A	5.64 m^3/s	4 x 1.41 m^3/s
Pass Forward Flow – First Overflow	N/A	N/A	0.456 m^3/s	

Note:
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	Clifton – 223.86 Strathcona – 223.86
2	Trunk Invert at Off-Take	223.80
3	Top of Weir	224.80
4	Relief Outfall Invert at Flap Gate	223.70
5	Low Relief SRS Interconnection (S-TE20003352)	225.2
6	Sewer District Interconnection (Aubrey)	225.35
7	Low Basement	229.97
8	Flood Protection Level	230.30

[a] City of Winnipeg Data, 2013

1.4 Previous Investment Work

A summary of the previous work in the Clifton district has been included in Table 1-3, and provides a summary of the district status in terms of data capture and study. The most recent study completed in Clifton was in 1979 with the *Conceptual Design Report for the Clifton Combined Sewer Relief Project* (James F. Maclaren Limited, 1979). The purpose of the conceptual design was to examine various alternatives to provide sewer relief for Clifton district, as well as considering pollution control for CSOs to the Assiniboine River.

An extensive SRS system was constructed within the Clifton district, as well as covering the adjacent Aubrey and Tylehurst districts, over an approximate length of 14 km between 1979 and 2013 (the majority was constructed in 1981). The SRS system is classified as the Strathcona SRS discharging to the Assiniboine river via a 2700 mm diameter outfall pipe.

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 Clifton 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.

Table 1-3. District Status

District	Most Recent Study	Flow Monitoring	Hydraulic Model	Status	Planned Completion
8 - Clifton	1979 - Conceptual	Future Work	2013	Study Complete	N/A

1.5 Ongoing Investment Work

There is ongoing maintenance and calibration of permanent instruments installed within the primary outfall within the Clifton 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 Clifton sewer district are listed in Table 1-4. The proposed CSO control projects will include in-line storage via control gate, floatable management via screening, and latent storage with flap gate control. 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 Tank	Off-line Storage Tunnel	Sewer Separation	Green Infrastructure	Real Time Control	Floatable Management
85% Capture in a Representative Year	✓	✓	-	✓	✓	-	-	-	✓	✓	✓

Notes:

- = not included
✓ = included

The existing CS system is suitable for use as in-line and latent storage. These control options would take advantage of the existing CS pipe network for additional storage volume. Existing DWF from the collection system would remain the same, and overall district operations would remain the same, although additional WWF will be collected from the SRS and transferred to the existing CS system and forwarded to the NEWPCC for treatment.

All primary overflow locations are to be screened under the current CSO control plan. The installation of a control gate at the primary CS outfall will be required for the screen operation. The control gate installation will also provide the mechanism for capture of additional in-line storage.

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 Latent Storage

Latent storage is proposed as a control option for the Clifton district. The latent storage level is partially controlled by the resulting backpressure of the river level on the Strathcona SRS outfall flap gate. However, the level of the Strathcona SRS outfall is sufficiently above the river level that insufficient volume capture is achieved from the latent storage provided by the flap gate only. Therefore, flap gate control has been recommended with this control option, to provide the additional latent storage volume desired. The latent storage design criteria are identified in Table 1-5.

Table 1-5. Latent Storage Conceptual Design Criteria

Item	Elevation/Dimension	Comment
Invert Elevation	223.70 m	
NSWL	223.86 m	
Trunk Diameter	2,700 mm	
Design Depth in Trunk	160 – 1740 mm	1.74 m for 1-year design event (depth varies with rainfall)
Maximum Storage Volume	23 - 6,740 m^3	Varies depending on rainfall, 6,740m^3 with 1-year design event. 23 m^3 provided with no flap control (single rainfall event modelled value)
Force Main	125 mm diameter	
Flap Gate Control	Yes	
Lift Station	Yes	
Nominal Dewatering Rate	0.040 m^3/s	Based on 24-hour emptying requirement between WWF events
RTC Operational Rate	TBD	Dependent on future RTC control option requirement and recommendation

Notes:

NSWL = normal summer water level
TBD = to be determined

The addition of a latent storage pump station (LSPS) and force main that connect to the CS system are necessary for the latent storage. The purpose of the LSPS is to transfer stored latent volume back into the CS system. The LSPS will operate to dewater the SRS system in preparation for the next runoff event, the requirement for the system to be ready for the next event within a 24-hour period after completion of the previous event. A conceptual layout for the LSPS and force main is shown on Figure 08-02. The pump station would be located to the east of the existing SRS outfall chamber within public land. The latent force main will route through city-owned land and connect to the interceptor sewer on Raglan Road and into the manhole (S-MH20010465). The pump station and force main construction would cause minimal disruption to local residents within the surrounding area.

As mentioned above, flap gate control for the SRS system is proposed to fully utilize the latent storage available in the SRS system. The operation of this flap control will be tied to the lowering of the control gate on the CS system. As soon as the control gate drops out of the way, resulting from the increasing level in the CS system to the critical elevation, the flap control allows full capacity outflow in the SRS system through the SRS outfall and flap gate. The actual levels in the SRS system at these times will vary depending on the rainfall characteristics.

Figure 08 identifies the extent of the SRS system within the Clifton district that would be used for latent storage. The extent shown on the figure is relative to the NSWL as the controlling elevation. The maximum storage level is related to the NSWL, flap gate control and the size and depth of the SRS system. Once the level in the SRS exceeds the river level or the control set point of the flap gate control, the flap gate opens, and the CS is discharged to the river. The lowest interconnection between the combined sewer and relief pipe is higher than the proposed latent and in-line storage control levels, as a result the additional storage contained within the two systems via in-line and latent storage would function independently.

As described in the standard details in Part 3C wet well sizing will be determined based on the final pump selection, operation and dewatering capacity required. The interconnecting piping between the new gate chamber and the pump station would be sized to provide sufficient flow to the pumps while all pumps are operating. Th flap gate control function is also described in the standard details in Part 3C.

1.6.3 In-Line Storage

In-line storage has been proposed as a CSO control for the Clifton district. The in-line storage will require the installation of a control gate at the CS outfall. The control gate will primarily be use to maximize the available hydraulic head in the district CS system, such that screening can be effectively operated. The gate will also provide a minor increase in the storage level in the existing CS to provide an increase to the volume capture. Should screening no longer be required for floatables management in this district, ultimately the in-line storage arrangements recommended in this sub-section should not be pursued.

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 the in-line storage are listed in Table 1-6.

Table 1-6. In-Line Storage Conceptual Design Criteria

Item	Elevation/Dimension	Comment
Invert Elevation	223.82 m	Downstream invert of pipe at weir
Trunk Diameter	2300 x 2970 mm	
Gate Height	0.59 m	Gate height based on half trunk diameter assumption
Top of Gate Elevation	225.40 m	
Bypass Weir Height	225.20 m	
Maximum Storage Volume	2,397 m^3	
Nominal Dewatering Rate	0.25 m^3/s	Based on existing sewage LS capacity
RTC Operational Rate	TBD	Future RTC / dewatering review on performance

The proposed control gate will cause combined sewage to back-up within the collection system to the extent shown on Figure 08. The extent of the in-line storage and volume is related to the top elevation of the bypass side weir. 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 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 CS LS will continue with its current operation while the control gate is in either position, with all DWF being diverted to the CS LS and pumped to the Main Interceptor pipe on

Wolseley Avenue. The CS LS will further dewater the in-line storage provided during a WWF event as downstream capacity becomes available.

Figure 08-01 provides an overview of the conceptual location and configuration of the control gate and screening chambers. The control gate would be installed in a new chamber within the trunk sewer alignment and located north of the CS LS. The dimensions of a new chamber to provide an allowance for a side weir for floatables control are 5.0 m in length and 3.6 m in width. The existing sewer configuration including the construction of an additional off-take, and force main modifications may have to be completed accommodate the new control gate chamber. This will be confirmed in future design assessments. This construction will be within city owned land as this is adjacent to the existing FPS and CS LS structures. The construction is expected to be minimal from a traffic aspect due to the location proposed being located off of a residential street, although construction traffic will be present in the local street area.

The physical requirements for the off-take and station sizing for a modification to pumping capacity have not been considered in detail, but they will be required in the future as part of an RTC program or FPS rehabilitation or replacement project.

The nominal rate for dewatering is already set at the existing pipe capacity as the district is a gravity discharge district. Any future considerations, 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 overflows at this district. This future RTC control will provide the ability to capture and treat more volume for localized storms by using the excess interceptor capacity where the runoff is less.

1.6.4 Floatables Management

Proposed floatables management will require installation of a screening system to capture floatable materials. The off-line screens will be designed to maintain the current level of basement flooding protection.

The type and size of screens depend on the specific station configuration and the hydraulic head available for operation. A standard design was assumed for screening and is described in Part 3C. The design criteria for screening, with an in-line control gate implemented, are listed in Table 1-7.

Table 1-7. Floatables Management Conceptual Design Criteria

Item	Elevation/Dimension/Rate	Comment
Top of Gate	225.40 m	
Bypass Weir Crest	225.20 m	
NSWL	223.86 m	
Maximum Screen Head	1.34 m	
Peak Screening Rate	0.76 m^3/s	
Screen Size	1.5 m wide x 1 m high	Modelled Screen Size

The proposed side bypass overflow weir and screening chamber will be located adjacent to the existing combined trunk sewer, as shown on Figure 08-01. The screens will operate once levels within the sewer surpass the bypass weir elevation. The side bypass weir upstream of the gate will direct 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 to the LS for routing 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 Clifton trunk. This will be confirmed during future assessment stage.

The dimensions for the screen chamber to accommodate influent from the side bypass weir, the screen area, and the routing of discharge piping downstream of the gate are 3.6 m in length and 3.1 m in width. The location of the screen will provide minimal interference with local private residencies although possible disruption from construction processes is possible. All land utilized has been determined to City-owned, as per the current zoning boundary maps.

1.6.5 Green Infrastructure

The approach to GI is described in more detail 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.

Clifton has been classified as a medium GI potential district. Land use in Clifton is mainly industrial and residential, the south end of the district is bounded by the Assiniboine River. Bioswales and green roofs may be suitable to the industrial areas while cisterns/rain barrels, and rain garden bioretention are suitable for the residential areas. Parking lots located in commercial areas are ideal for paved porous pavement.

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.

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.

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.

The latent storage would take advantage of the SRS infrastructure already in place, therefore, minimal additional maintenance will need to be anticipated. The proposed latent LSPS will require regular maintenance that would depend on the frequency of operation. The flap control gate will require maintenance inspection for continued assurance that the flap gate would open during WWF 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 1-8.

Table 1-8. InfoWorks CS District Model Data

Model Version	Total Area (ha)	Contributing Area (ha)	Population	% Impervious	Control Options Included in Model
2013 Baseline	403	384	8,160	46	N/A
2037 Master Plan – Control Option 1	403	384	8,160	46	Lat St, FGC, IS, SC

Notes:

Lat St = Latent Storage

FC = Flap Gate Control
IS = In-line Storage
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 1-9 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 1-9 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 1-9. District Performance Summary – Control Option 1

Control Option	Preliminary Proposal Annual Overflow Volume (m^3)	Master Plan Annual Overflow Volume (m^3)	Overflow Reduction (m^3)	Number of Overflows	Pass Forward Flow at First Overflow [c]
Baseline (2013)	153,921	114,875	-	41	0.456 m^3/s
In-line Storage	153,619 [a]	97,059 [b]	17,816	41	0.296 m^3/s
Latent Storage		113,932 [b]	943	15	0.296 m^3/s
Flap Gate Control		104,302 [b]	10,573	15	0.292 m^3/s
Control Option 1	**153,397**	**88,392**	**26,483**	**15**	**0.292 m^3/s**

[a] In-line and latent storage not modelled separately in the Preliminary Proposal assessment. Flap gate control not considered in PP assessment.

[b] Assessment completed with individual district models and reductions attributed to full model impact overflows provided

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

The selection of a flap gate control for the latent storage was not considered during the Preliminary Proposal, although further assessment of the level interaction between the SRS outfall and NSWL resulted in this being reconsidered during the CSO Master Plan phase.

The percent capture performance measure is not included in Table 1-9, 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 1-10. The cost estimates are a Class 5 planning level estimate with a level of accuracy of minus 50 to plus 100 percent.

Table 1-10. 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 (Over 35-year period)
Latent Storage	N/A [a]	$2,410,000	$87,000	$1,860,000
Latent Flap Gate Control		$2,420,000	$42,000	$900,000
In-line Storage	$7,740,000 [b]	$2,730,000 [c]	$42,000	$900,000
Screening		$2,730,000 [d]	$48,000	$1,040,000
Subtotal	**$7,740,000**	**$10,290,000**	**$219,000**	**$4,700,000**
Opportunities	N/A	$1,030,000	$22,000	$470,000
District Total	**$7,740,000**	**$11,320,000**	**$241,000**	**$5,170,000**

[a] Latent Storage and flap gate control not included in the Preliminary Proposal 2015 costing. Solution developed as refinement to Preliminary Proposal work following submission of Preliminary Proposal costs. Costs for the Latent Storage item of work found to be $1,530,000 in 2014 dollars

[b] Solution developed as refinement to Preliminary Proposal work following submission of Preliminary Proposal costs. Costs for this item of work found to be $3,000,000 in 2014 dollars

[c] Cost associated with new off-take construction, as required, to accommodate control gate location and allow intercepted CS flow to reach existing Clifton LS not included

[d] 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 Mast Plan cost estimate includes the following:

- Capital costs and O&M 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 difference 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 1-11 below.

Table 1-11. Cost Estimate Tracking Table

Changed Item	Change	Reason	Comments
Control Options	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 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 balance out over the entire CS area
	Latent Storage	Not included in the Preliminary Proposal cost submission, modelled as part of Preliminary Proposal refinements.	Add to Master Plan recommended solutions.
	Flap Gate Control	Not included in the Preliminary Proposal. Determined as necessary to fully take advantage of available latent storage.	Added in conjunction with Latent Storage
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 Costs	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 1-12 provides a description of how the target adjustment could be met by building off proposed work identified in Control Option 1.

Overall the Clifton district would be classified as a low potential for implementation of complete sewer separation as the only feasible approach to meet future performance targets. 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 to meet future performance targets.

Table 1-12. Upgrade to 98 Percent Capture in a Representative Year Summary

Upgrade Option	Viable Migration Options
98 Percent Capture in a Representative Year	• Opportunistic separation • Off-line storage (Tank/Tunnel) • Increased use of GI

The control options for the Clifton district has been aligned for the 85 percent capture performance target based on the system wide assessment. The expandability of the district to the future 98 percent capture target will be restricted depending on the interaction of the system wide performance.

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 1-13.

Table 1-13. 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	R	-	-	O	-	-	-
2	Existing Lift Station	-	R	-	-	-	-	R	-
3	Flood Pumping Station	-	-	-	-	O	-	-	-
4	Construction Disruption	-	-	-	-	-	-	-	-
5	Implementation Schedule	-	-	-	-	-	-	R	-
6	Sewer Condition	R	R	-	-	-	-	-	-
7	Sewer Conflicts	R	R	-	-	-	-	-	-
8	Program Cost	O	O	-	-	-	-	-	O
9	Approvals and Permits	-	-	-	-	-	R	-	-

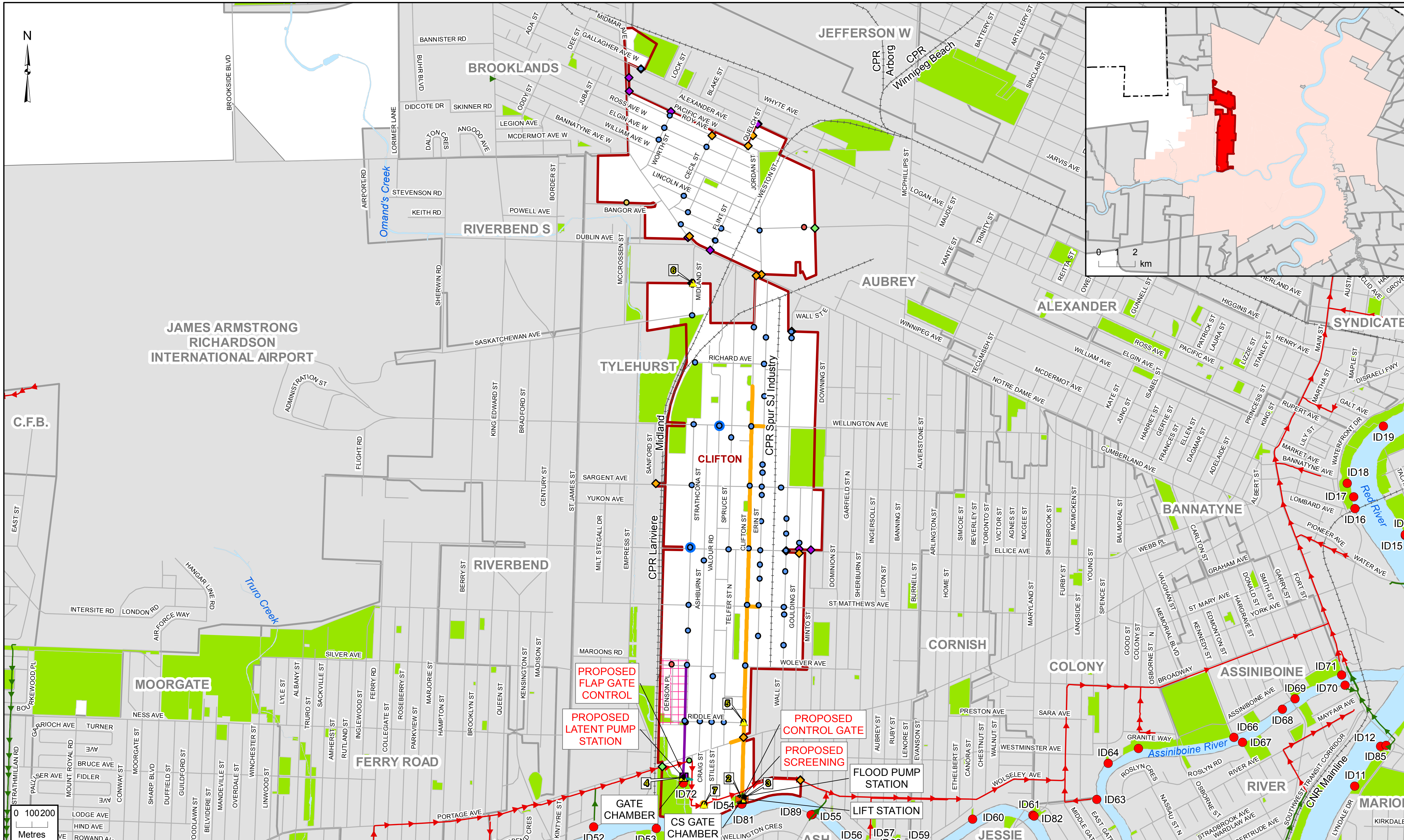
Table 1-13. Control Option 1 Significant Risks and Opportunities

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
10	Land Acquisition	-	-	-	-	-	R	-	-
11	Technology Assumptions	R	-	-	-	-	O	O	-
12	Operations and Maintenance	R	R	-	-	-	R	O	R
13	Volume Capture Performance	O	O	-	-	-	O	O	-
14	Treatment	R	R	-	-	-	O	O	R

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

1.12 References

James F. Maclaren Limited. 1979. *Conceptual Design Report for the Clifton Combined Sewer Relief Project*. Prepared for the City of Winnipeg Water and Waste Department. January.



LEGEND

Primary Weir	Inter-System Connection	District Boundary Crossing	Interceptor Sewer	District Boundary
Critical Elevation	CS - LDS	CS	Force Main	Watercourse
CSO Outfall	CS - WWS	SRS	Street	Green Space
Low CS Manhole	SRS - CS	WWS	Railway	
Low SRS Connection	SRS - WWS			

CSO MASTER PLAN PROPOSED SOLUTIONS

- Proposed Control Gate
- Proposed SRS Latent Storage Pump
- Latent Storage Limit
- Extent of In-line Storage
- Latent Force Main
- Sewer Separation - Ready

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

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

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WATER AND WASTE DEPARTMENT

FIGURE 08
District Overview Map
Sewer District: Clifton
City of Winnipeg
Combined Sewer Overflow Master Plan

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LEGEND

Primary Weir
Critical Elevation
CSO Outfall
Manhole
Flap Gate
Sluice Gate
Pump Location
Force Main
Sewer By Type
CS
SRS
WWS
Control Structure Type
Gate Chamber
Pump Station Type
Flood Pump Station
Lift Station

CSO MASTER PLAN PROPOSED SOLUTIONS

Control Gate
Screening

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

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

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WATER AND WASTE DEPARTMENT

FIGURE 08-01
Control Gate and Screening
Sewer District: Clifton
City of Winnipeg
Combined Sewer Overflow Master Plan

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LEGEND

- Critical Elevation
- CSO Outfall
- Manhole
- Flap Gate
- Sluice Gate

Sewer By Type

- CS
- LDS
- SRS
- WWS

Control Structure Type

- Gate Chamber

- Land Parcel

CSO MASTER PLAN
PROPOSED SOLUTIONS

- Proposed Latent Force Main
- Latent Pump

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

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

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FIGURE 08-02
Latent SRS Control
Sewer District: Clifton
City of Winnipeg
Combined Sewer Overflow Master Plan