CSO Master Plan

Ash District Plan

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City of Winnipeg

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1. Ash District

1.1 District Description

Ash district is located towards the southwestern limit of the combined sewer (CS) area along the southern bank of the Assiniboine River. Ash is bounded by the Assiniboine River to the north; Cambridge Street to the east, Centennial Street North, Kenaston Boulevard, and Doncaster Street to the west; and Wilkes Avenue to the south. Ash district contains numerous major transportation routes that pass through the district including Kenaston Boulevard, Taylor Avenue, Grant Avenue, Corydon Avenue, and Academy Road. Kenaston Boulevard passes north-south through Ash and provides access across the Assiniboine River. The Midland rail line connects to the Canadian Pacific Railway Lariviere rail lines and passes through the center of the Ash district. Ash is surrounded by Jessie and Cockburn districts to the east, Lindenwoods East and West to the south, and Doncaster to the west.

Land use in Ash is mainly residential with the remainder being commercial use. The commercial businesses are found along the busier routes, including Corydon Avenue, Grant Avenue and Academy Avenue. The residential land is made up of single-family homes with multi-family and apartment complexes found in the southern section of Ash near Wilkes Avenue. Numerous schools and recreational areas are distributed around the district, with the Manitoba Youth Centre on Tuxedo Avenue and River Heights School and Community Centre occupying the most non-residential land use area. Approximately 53 ha of the district is classified as greenspace.

1.2 Development

A Route 90 Improvement Study is currently underway that will lead to a significant amount of construction and right of way adjustments along Route 90/Kenaston Boulevard. This work, which will impact both Doncaster and Ash districts, could impact the Combined Sewer Overflow (CSO) Master Plan. The Route 90 work is discussed further in Section 1.5.

The Waverley Underpass Project is currently ongoing at the time of writing and is anticipated to conclude in 2020. This work does not affect the CSO Master Plan.

1.3 Existing Sewer System

Ash district encompasses an area of 744 ha[1] based on the district boundary and includes both a combined sewer (CS), wastewater sewers (WWS), and a storm relief sewer (SRS) system. As shown in Figure 03, there is approximately 6 percent (45 ha) already separated and 1 percent (7 ha) of the district is considered separation ready.

The Ash CS system includes a flood pump station (FPS), CS lift station (LS), and a CS outfall gate chamber located adjacent to the Assiniboine River at Wellington Crescent and Ash Street, at the Ash CS outfall. Sewage flows collected in Ash converge to the 1720 mm by 2220 mm egg-shaped sewer trunk on Academy Road which connects to the main 2440 mm by 3150 mm egg-shaped sewer trunk on Ash Street. The CSs meet at the intersection of Ash Street and Wellington Crescent and flow to the CS outfall. CS is also received from the Doncaster and Tuxedo districts, with the intercepted CS from these districts discharging into the Ash CS system at the intersection of Willow Avenue and Doncaster Street.

The SRS predominately drains towards the Renfrew SRS outfall located adjacent to the Assiniboine River at Wellington Crescent and Renfrew Street. There are also areas of SRS constructed to provide localized relief, but which tie back into the existing CS system. Minor SRS work was completed surrounding

[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.

Wellington Crescent, ultimately discharging into a dedicated SRS outfall near Wellington Crescent and Academy Road.

During dry weather flow (DWF), the SRS system is not required; sanitary sewage is diverted by the primary weir at the Ash CS Outfall, through the 600 mm off-take pipe to the Ash CS LS, where it is pumped across the Assiniboine River to the Main Interceptor pipe in the Aubrey district and on to the North End Sewage Treatment Plant (NEWPCC) for treatment.

During wet weather flow (WWF), any flow in the CS system that exceeds the diversion capacity overtops the primary weir and is discharged to the river. A flap and sluice gate are in place on the CS outfall to prevent river water from flowing into the CS under high river level conditions. When the river level is high such as this, the flap back prevents gravity discharge of any excess CS which spills over the primary weir within this outfall pipe. In this case the excess flow is instead pumped by the Ash FPS to a dedicated FPS outfall where it is discharged by gravity into the river. This FPS outfall does not have a flap gate or positive gate. The FPS contains four pumps to accommodate the wet weather flow (WWF) response received by the district.

The SRS system provides relief to the CS system in Ash district during WWF events. The WWF is drained by gravity into the main SRS outfall on Renfrew Street or the smaller outfall near the western edge of Ash on Wellington Crescent. Two flap gates are located on the Renfrew outfall pipe to prevent river water from backing up into the Renfrew SRS under high river level conditions on the Assiniboine River. The Renfrew SRS outfall is also equipped with a positive gate for temporary dewatering purposes and to provide emergency protection to the SRS system from flooding during high river level conditions. SRSs are implemented throughout the district and connect to the CS via interconnections.

A small number of land drainage sewers (LDSs) exist in the northwestern part of the district. This section of LDS collects surface runoff and conveys it to a separate LDS outfall. South of the CPR Mainline the CS system has been separated with the wastewater sewer (WWS) connecting into the CS system north of the tracks.

The outfalls to the Assiniboine River are as follows:

ID55 (S-MA70033504) – Ash CS Outfall

ID51 (S-MA60006673) – Wellington SRS Outfall

ID53 (S-MA70024441) - Renfrew SRS Outfall

ID89 (S-MA70016005) – Ash FPS Outfall

1.3.1 District-to-District Interconnections

There are several district-to-district interconnections between Ash and the surrounding districts. Each interconnection is shown in Figure 03 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

- Dual 300 mm force main river crossing carries flow from the Ash LS across the Assiniboine River to the Aubrey district Man interceptor pipe and on to the North End Sewage Treatment Plant (NEWPCC) for treatment.
  - Aubrey district south of Wolseley Avenue invert = 230.64 m (S-MH70006432)

1.3.1.2 Interceptor Connections – Upstream of Primary Weir

Doncaster

- A 750 mm CS pipe under surcharged flow conditions in the Doncaster district flows by gravity southbound on Doncaster Street and connects into the CS system in Ash:
  - Willow Avenue and Doncaster Street invert = 226.37 m (S-MH60006151)

1.3.1.3 District Interconnections

Doncaster

CS to CS

- Common high point CS manhole:
  - Kenaston Boulevard and Corydon Avenue = 227.70 m (S-MH60006019)

Lindenwoods East (Area 3)

WWS to WWS

- A 250 mm WWS sanitary sewer flows into Ash district and crosses the district boundary at the intersection of Waverley Street and Victor Lewis Drive:
  - Waverley Street and Victor Lewis invert at Ash district boundary = 228.87 m

LDS to LDS

- A 375 mm LDS flows into Ash district at Wilkes Avenue and is discharged into a stormwater retention basin in Ash:
  - Wilkes Avenue near Waverley Street invert at Ash district boundary = 228.23 m
- A 375 mm LDS pipe from Area 3 flows northbound by gravity into Ash LDS system at Wilkes Avenue and Victor Lewis Drive:
  - Wilkes Avenue and Victor Lewis Drive invert at Ash district boundary = 228.95 m (S-MH70001787)
- Two LDS systems convey flow out of Ash district, cross the district boundary and discharge into a stormwater retention basin in Lindenwoods East:
  - Waverley Street and Victor Lewis Drive invert at Ash district boundary = 229.66 m

Lindenwoods West (Area 3.1)

LDS to LDS

- A 750 mm LDS system convey flow out of a small portion of Ash district, crosses the district boundary and discharges into a stormwater retention basin in Lindenwoods West:
  - Sterling Lyon Parkway and Brockville Street at Ash district boundary = 229.48 m
- A LDS siphon crosses from Lindenwoods West to Ash district, and then connects into the LDS system in Ash. This LDS system discharges either into a stormwater retention basin in Ash or the one in Lindenwoods West:
  - Wilkes Avenue and Paget Street invert at Ash district boundary = 230.24 m

Willow

LDS to LDS

- A 600 mm LDS overflow is located in Ash district and flows southbound by gravity into Willow district:
  - Fennell Street and Wilson Place invert at Willow district boundary = 231 m (S-MH60014575)

Jessie

<u>CS to CS</u>

- A 300 mm CS at Corydon Avenue and Cambridge Street flows eastbound by gravity into Jessie district. The manhole at the district boundary in Ash is also a high point:
  - Corydon Avenue and Cambridge Street invert at Jessie district boundary = 229.25 m (S-MH60010068)
  - Common high point CS manhole = 229.50 m

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.

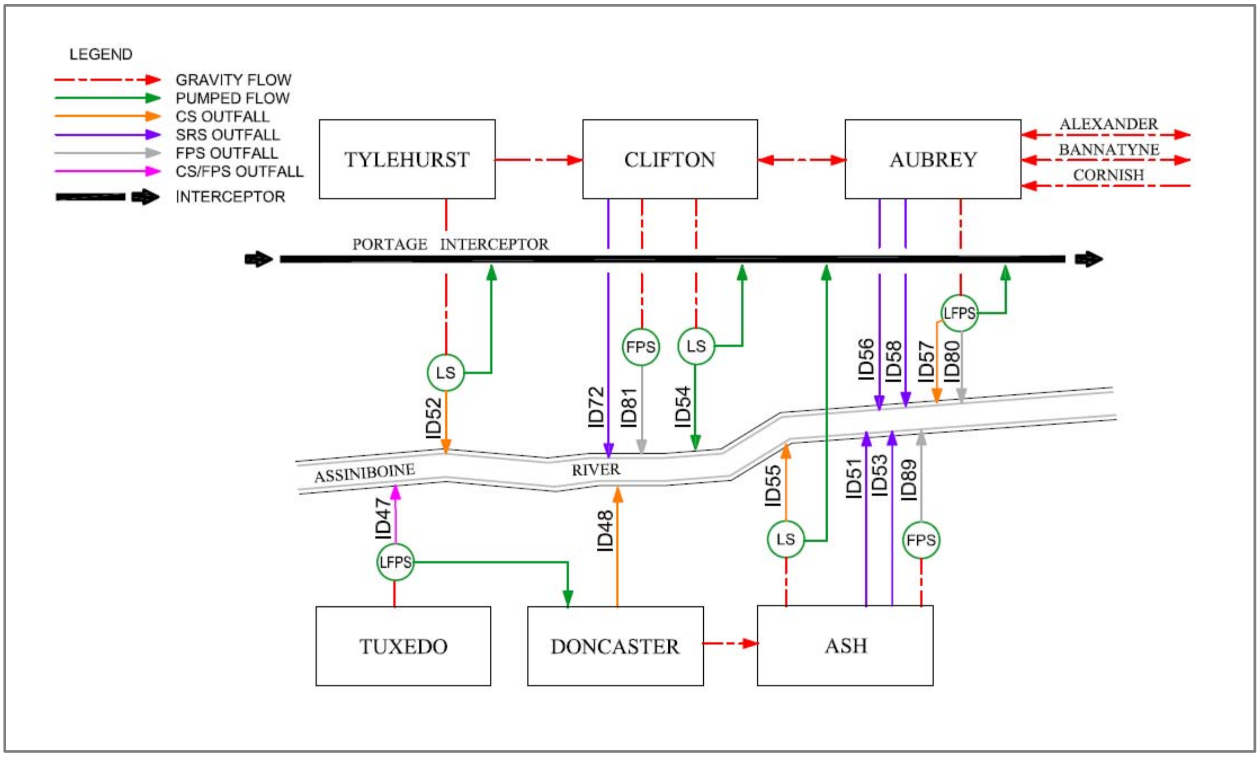


Figure 1-1. District Interconnection Schematic

1.3.2 Asset Information

The main sewer system features for the district are shown on Figure 03 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 (ID55)	S-MH70011795.1	S-MA70033504	3480 mm	Assiniboine River Invert: 222.98 m
Flood Pumping Outfall (ID81)	S-AC70007362.1	S-MA70016005	2100 mm	Assiniboine River Invert: 224.87 m
Other Overflows	N/A	N/A	N/A	
Main Trunk	S-TE70007360.1	S-MA70016011	2440 x 3150 mm	Invert: 223.26 m
SRS Outfalls	S-CO70011421.1 S-MH60005292.1	S-MA70024441 S-MA60006673	2400 mm 300 mm	Assiniboine River Invert: 222.2 m

				Invert: 226.0 m
SRS Interconnections	N/A	N/A	N/A	30-SRS-CS Interconnections throughout district.
Main Trunk Flap Gate	S-MH70011794.1	S-CG00000743	2500 mm	Invert: 223.83 m
Main Trunk Sluice Gate	ASH_GC.1	S-CG00000744	1800 x 2100 mm	Invert: 223.47 m
Off-Take	S-TE70007363.1	S-MA70017767	600 mm	Invert: 223.47 m
Dry Well	N/A	N/A	N/A	
Lift Station Total Capacity	S-TE70027396.2 S-TE70027398.1 S-TE70027395.2 (stand-by)	N/A	0.280 m^3/s	1 x 0.19 m^3/s max discharge 1 x 0.09 m^3/s (0.19 m^3/s max discharge) 1 x 0.00 m^3/s (0.19 m^3/s max discharge)
Lift Station ADWF	N/A	N/A	0.101 m^3/s	Ash district ADWF as 0.094 m^3/s
Lift Station Force Main	S-YY70021058.2	S-MA70044147	300 mm	2 x 300 mm
Flood Pump Station Total Capacity	N/A	N/A	5.24 m^3/s	3 x 1.42 m^3/s, 1 x 0.98 m^3/s
Pass Forward Flow – First Overflow	N/A	N/A	0.660 m^3/s	

Notes:

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

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

Table 1-2. Critical Elevations

Reference Point	Item	Elevation (m)[a]
1	Normal Summer River Level	Ash – 223.85 Renfrew – 223.88 Wellington – 224.21
2	Trunk Invert at Off-Take	223.47
3	Top of Weir	224.03
4	Relief Outfall Invert	Renfrew - 222.48
5	Relief Interconnections (S-MH60006951)	224.97
6	Sewer District Interconnection (Doncaster Street and Tuxedo Avenue)	Invert at district boundary: 226.62
7	Low Basement	230.43
8	Flood Protection Level	230.30

[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 Ash was in 1981 with the Ash District Combined Sewer Relief (M.M. Dillon Ltd, 1981).

This study discussed the upgrading of the Ash CS district to reduce surcharge levels and basement flooding.

Significant SRS construction was completed throughout Ash from 1979 - 1981 to relief the basement flooding risk in the district. This work included the construction of the dedicated SRS outfall at Wellington Crescent and Waverley Street to compliment the Renfrew SRS outfall constructed in the 1960s. Ultimately this Waverley outfall was converted do a dedicated LDS outfall providing partial separation to the Ash district.

In 2013 further SRS relief work was completed in the northwest corner of the Ash District to provide localized CS relief to properties on Wellington Crescent immediately east of Kenaston Boulevard. This work included the construction of the Wellington dedicated SRS outfall.

Starting in 2014, the City initiated a preliminary design study to focus on relief of the Waverley Street and Taylor Avenue. The Waverley Underpass Study provided a high level design for a grade separation of Waverley Street and the Canadian National Railway (CNR) that passes through Ash District. The objective of this study was to improve the transportation network within the area. The construction is currently underway with plans for the project to be completed in late 2019. The construction impacts the portions of the southeast Ash district: primarily along Waverley Street, from Grant Avenue to Wilkes Avenue and along Taylor Avenue. From Lindsay Street to Cambridge Street Improvements to the land drainage were proposed, mainly the separation of Taylor Avenue and Waverley Street, The area south of Taylor Avenue has already been previously separated as part of this work.

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 Ash 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	Expected Completion
3 - Ash	1981	Future Work	2013	Planning Separation	N/A

Source: Report on Ash District Combined Sewer Relief, 1981

1.5 Ongoing Investment Work

Proposed investment work is being considered for Route 90 from Taylor Avenue to Ness Avenue, which will occur in both Doncaster and Ash. Kenaston Boulevard runs through the north section of Ash and, therefore, will affect the sewer systems in this district. The existing combined sewers will be evaluated for separation potential as part of the Route 90 Widening Project. Opportunistic separation will be incorporated where there is benefit. The separation costs may be reduced if separation work is planned as part of road reconstruction.

There is ongoing maintenance and calibration of permanent instruments installed within the Ash outfall. This consists of monthly site visits in confined entry spaces to verify that physical readings concur with displayed transmitted readings and replacing desiccants when 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 Ash sewer district are listed in Table 1-4. The proposed CSO control projects will include latent storage with flap gate control, partial separation, in-line storage via control gate floatables control 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 Tank	Off-line Storage Tunnel	Sewer Separation	Green Infrastructure	Real Time Control	Floatable Management
85 Percent Capture in a Representative Year	✓	✓	-	✓	✓	-	-	✓	✓	✓	✓

Notes:

- = not included
✓ = included

The existing CS and SRS systems are suitable for use as in-line and latent storage. These proposed control options would take advantage of the existing CS and SRS pipe networks for additional storage volume. Existing DWF levels experienced within the collection system, and overall district operations would remain the same. Additional WWF during rainfall events however will be collected from the SRS and CS systems and forwarded to the NEWPCC for treatment.

Floatable control will be necessary to capture any 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 floatable capture level. Installation of a control gate will be required for the screen operation. The control gate installation will additionally provide the mechanism for capture of the additional in-line storage.

Partial separation has been proposed to be completed in conjunction with the Route 90 widening work and opportunistic additional separation would be beneficial at intersecting local roads. This is also part of the Doncaster district proposed control option work.

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

The partial sewer separation project for Ash will provide benefits to the CSO program when complete. The work includes installation of a new LDS trunk and collector sewers within the district as part of the Route 90 Widening Project. The existing CS trunks along Kenaston Boulevard will be separated into distinct storm and sanitary sewer systems, which will allow for sanitary sewage that contains untreated domestic, industrial, and commercial wastes to be separated from the storm runoff. A new LDS system would allow the storm runoff to be discharged into the Assiniboine River during rainfall events. The existing combined sewers would be retained for use as separate WWS to convey sanitary sewage through the Ash sewer system to the appropriate treatment plant. The approximate area of sewer separation is shown on Figure 03.

The flows to be collected after the Ash partial separation will be as follows:

- Dry weather flows will remain the same for Ash district with all DWF being diverted to the Ash CS LS and into Aubrey district.

- The Ash WWF response overall will be reduced as the section along Route 90 will consist of sanitary sewage combined with foundation drainage.

Partial sewer separation will provide a reduction of overflows when evaluated with the 1992 representative year. In addition to reducing the CSO volume, the benefits of the Ash partial separation include a reduction of the amount of flood pumping required at the Ash FPS. The complete sewer separation work proposed in this CSO Master Plan for the upstream districts of Doncaster and Tuxedo will also contribute to the reductions experienced in the Ash district, as the intercepted CS from each of these districts also contribute to the CS within the Ash district.

1.6.3 Latent Storage

Latent storage is proposed as a control option for the Ash district. The latent storage level in the system is controlled by the river level, and the resulting backpressure of the river level on the SRS outfall flap gate, as explained in Part 3C. However, the level of the Renfrew SRS outfall is only partially above the NSWL when modelled with the 1992 representative year. This only provides a modest benefit in terms of additional volume capture with latent storage at this location controlled only by the river level. Therefore, a mechanical gate control has been additionally recommended for this control option, to provide the additional latent storage volume. This will allow the SRS outfall flap gate to remain closed regardless of the river level conditions on the Assiniboine River. Details of the SRS flap gate control are provided in the standard details in Part 3C. The latent storage design criteria are identified in Table 1-5. The storage volumes indicated in Table 1-5are based on the river level conditions over the course of the 1992 representative year, with supplemental mechanical flap gate control provided as required.

Table 1-5. Latent Storage Conceptual Design Criteria

Item	Elevation/Dimension	Comment
Invert Elevation	222.69 m	
NSWL	223.88 m	
Trunk Diameter	2400 mm	
Design Depth in Trunk	1190 mm	
Maximum Storage Volume	1779 m^3	
Force Main	150 mm	
Flap Gate Control	Yes	
Pump Station	Yes	
Nominal Dewatering Rate	0.03 m^3/s	Based on 24 hour emptying requirement
RTC Operational Rate	TBC	Future RTC/dewatering review on assessment

Notes:

NSWL – normal summer water level

RTC – Real Time Control

The addition of a pump and force main that connects back to the CS system will be required for latent storage. A conceptual layout for the latent storage pump station (LSPS) and force main is shown on Figure 03-02. The LSPS will be located adjacent to the existing gate chamber near Wellington Crescent. The LSPS will direct flows southwest to the nearby 300 mm CS sewer on Renfrew Street and into the manhole (S-MH70028046) on the south curb on Wellington Crescent and the back lane of Renfrew Street. This location for latent storage dewatering return was evaluated and capable of accommodating the returned pump flow and selected as appropriate. The pump station will operate to dewater the SRS system in preparation for the next runoff event, to meet the requirement for the system to be ready for the next event within a 24-hour period after completion of the previous event.

The LSPS would connect to the SRS outfall chamber and discharge back to the CS system once capacity allows. Figure 03 identifies the extent of the SRS system within Ash district that would be used for latent storage. The maximum storage level is directly related to the NSWL and the size and depth of the SRS system. Once the level in the CS system exceeds the in-line control gate (see Section 1.6.4), the mechanical flap gate control provided at the Renfrew SRS outfall will be deactivated. At this point the combined sewage within the SRS system will be discharged to the river, assuming river levels are sufficiently low to allow discharge. The Wellington SRS system located in the northwest corner of the Ash district was also evaluated. The Wellington SRS outfall pipe invert elevation was found to be consistently above the NSWL under the 1992 representative year. It therefore, does not contribute to the available latent storage in Ash utilizing the Renfrew SRS outfall.

The lowest interconnection between the combined sewer and relief pipe was found to be higher than the proposed latent and in-line storage control levels. This will allow the two systems would function independently to provide additional volume capture.

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

1.6.4 In-Line Storage

In-line storage has been proposed as a CSO control for the Ash 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 and provide additional hydraulic head for screening operations.

A standard design was assumed for the control gate, as described in Part 3C. The standard approach was initially 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 bypass weir and control gate levels were then subsequently assessed to a level below the existing FPS operational levels, as the half trunk diameter initial level assessment indicated that the FPS operated prior to the opening of the control gate. This would increase the operational run period of the FPS and is not considered beneficial to the control option.

The design criteria for in-line storage are listed in Table 1-6.

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

Item	Elevation/Dimension	Comment
Invert Elevation	223.30 m	
Trunk Diameter	2440 x 3150 mm	Egg-shaped
Gate Height	0.90 m	Flood pumping station assessment max operational level
Top of Gate Elevation	224.40 m	
Maximum Storage Volume	2000 m^3	
Nominal Dewatering Rate	0.28 m^3/s	Existing CS LS pump capacity
RTC Operational Rate	TBD	Future RTC/dewatering review on assessment

Note:
RTC = Real Time Control

TBD = to be determined

The proposed control gate will cause combined sewage to back-up in the collection system to the extent shown on Figure 03. 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 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 to 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. The CS LS will further dewater the in-line storage provided during a WWF event as downstream capacity becomes available.

Figure 03-01 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 existing trunk sewer alignment near the existing FPS. The dimensions of the chamber will be 5.1 m in length and 3.7 m in width to accommodate the gate, with an allowance for a longitudinal overflow weir. The proposed location is within the existing Ash CS LS and gate chamber layout and based on the available potential space. The existing sewer configuration may require the construction of an additional off-take pipe to be completed, if the future detailed design establishes that the proposed gate chamber cannot encompass the existing primary weir chamber. This will allow CS flows captured by the proposed control gate to be diverted to the Ash CS LS, ensuring that the system performs as per the existing conditions. The existing primary weir would remain in place to allow flow diversion to continue when the control gate is in its lowered position. 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 CS LS pumping capacity. This allows dewatering through the existing interceptor system within 24 hours following a runoff event, allowing it to recover in time for a subsequent event. Future RTC / dewatering assessment will be necessary to define additional rates. This would provide some flexibility in the ability to increase the dewatering rate for spatial rainfall events. This would dewater the district more quickly, to capture and treat more volume for these localized storms by using the excess interceptor capacity where the runoff is less.

1.6.5 Floatables Management

Floatables management will require installation of a screening system to capture floatable materials. The off-line screens will be proposed to maintain the current level of basement flooding protection. The type and size of screens depend on the specific station configuration and the head available for operation. A standard design was assumed for screening and is described in Part 3C. The design criteria for screening with gate control implemented, are listed in Table 1-7.

Table 1-7. Floatables Management Conceptual Design Criteria

Item	Elevation/Dimension/Rate	Comment
Top of Gate	224.40 m	
Bypass Weir Crest	224.30 m	
Normal Summer Water Level	223.85 m	
Maximum Screen Head	0.69 m	
Peak Screening Rate	0.65 m^3/s	
Screen Size	1.5 m x 1.0 m	Modelled Screen Size

The proposed side overflow bypass weir and screening chamber will be located adjacent to the proposed control gate and existing CS trunk, as shown on Figure 03-01. The screens will operate with the control gate in its raised position.. A side bypass weir upstream of the gate will direct the flow to the screens located in the new screening chamber, with screened flow discharged to the downstream side of the gate to the river. The side bypass weir height will be set to the critical performance level of the control gate. The screening chamber will include screenings pumps with a discharge returning the screened material to the LS for routing to the NEWPCC for removal.

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 3.2 m in length and 3.1 m in width. The existing sewer configuration may have to be modified to accommodate the new chamber.

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.

Ash has been classified as a medium GI potential district. Land use in Ash is mainly residential with a small amount of commercial, and the north end of the district is bounded by the Assiniboine River. This district would be an ideal location for cisterns/rain barrels, and rain garden bioretention. There are a few commercial areas which may be suitable to green roofs and parking lot areas which would be ideal for paved porous pavement.

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 separated part of 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 district.

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 will take advantage of the SRS infrastructure already in place; therefore, minimal additional maintenance will be required for the sewers. The proposed LSPS and dewatering pumps will require regular maintenance that would depend on the frequency of operation. The flap control gate mechanisms will require maintenance inspections for continued assurance that the flap gate would open during WWF events, expected to be based on the number of overflows for the district..

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	818	818	21,358	24	N/A
2037 Master Plan – Control Option 1	818	774	21,258	23	IS, Lat St, SC, SEP, FGC

Notes:

IS = In-line StorageLat St = Latent Storage
SC = Screening
SEP = Separation

FGC – Flap Gate Control

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. 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; these are listed to provide an indication of benefit gained only and are independent volume reductions.

Table 1-9. 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 [c]
Baseline (2013)	356,385	341,484	-	27	0.660 m^3/s
Latent Storage	347,453 [a]	315,960 [b]	25,524	22	0.660 m^3/s

Table 1-9. 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 [c]
Latent & In-Line Storage	N/A [a]	312,942 [b]	3,018	22	0.569 m^3/s
Latent (flap gate control), In-Line & Partial Separation		258,264	54,678	22	0.617 m^3/s
Control Option 1	**355,500**	**258,264**	**83,220**	**22**	0.617 m^3/s

[a] Latent storage and in-line storage not simulated independently during the Preliminary Proposal assessment. Separation not included in PP

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

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

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 **Error! Reference source not found.**. The cost estimates are a Class 5 planning level estimates with a level of accuracy of minus 50 percent to plus 100 percent.

Table 1-10. District Cost Estimate – 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]	$2,590,000	$72,000	$1,550,000
Flap Gate Control	N/A [b]	$2,340,000	$33,000	$710,000
In-Line Storage	N/A [a]	$5,100,000 [d e]	$61,000	$1,320,000
Screens		$2,550,000 [f]	$55,000	$1,190,000
Partial Separation [c]	N/A [c]	$29,100,000	$17,000	$370,000
Subtotal	**N/A**	**$41,680,000**	**$238,000**	**$5,140,000**
Opportunities	N/A	$4,170,000	$24,000	$510,000
District Total	**N/A**	**$45,850,000**	**$262,000**	**$5,650,000**

[a] Latent Storage, Screening and In-Line Storage not included in the original Preliminary Proposal 2015 costing submission. 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 $1,710,000 in 2014 dollars, Costs for the Screening and In-Line Storage items of work found to be

$4,320,000 in 2014 dollars.

[b] Flap Gate Control not included in the Preliminary Proposal 2015 costing

[c] Costs for sewer separation may be shared with Public Works budget for the Route 90 widening. Sewer separation not originally proposed as proposed as part of Preliminary Proposal costing.

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

[e] Full control gate structure not needed at Renfrew SRS as existing chamber structure to be utilized for flap gate control. Cost revised after submission of preliminary CO1MP costs. Cost for this item found to be $2,760,000 in 2019 dollars.

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

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

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

Cost estimates were prepared during the development of the Preliminary Proposal and updated for Phase 3 during the CSO Master Plan development. The differences identified between the Preliminary Proposal and the CSO Master Plan are accounting for the progression from an initial estimate used to compare a series of control options, to an estimate focusing on a specific level of control for each district. Any significant differences between the Preliminary Proposal and CSO Master Plan estimates are identified in Table 1-11.

Table 1-11. Cost Estimate Tracking Table

Changed Item	Change	Reason	Comments
Control Options	In-Line Storage	A control gate was not included in the Preliminary Proposal estimate.	Added for the MP to further reduce overflows
	Screening	Not included in the Preliminary Proposal estimate.	Added in conjunction with the Control Gate.
	Latent Storage	Not included in the Preliminary Proposal estimate.	Added for the MP to further reduce overflows
	Flap Gate Control	Not included in Preliminary Proposal estimate	Added for improvement to Master Plan options
	Partial Separation	Not included in the Preliminary Proposal estimate.	Added for the MP to further reduce overflows
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, 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 regulatory target adjustment could be met by building off the proposed work identified for Control Option 1.

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

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

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

The Ash district control options have been selected to align with the system wide basis to achieve the 85 percent capture performance target. The expandability of this district to meet the 98 percent capture future target would be achieved on a stepped approach from the system wide basis. The interaction with the upstream district control options implementation i.e. separation of Tuxedo and Doncaster, will also impact this district's 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

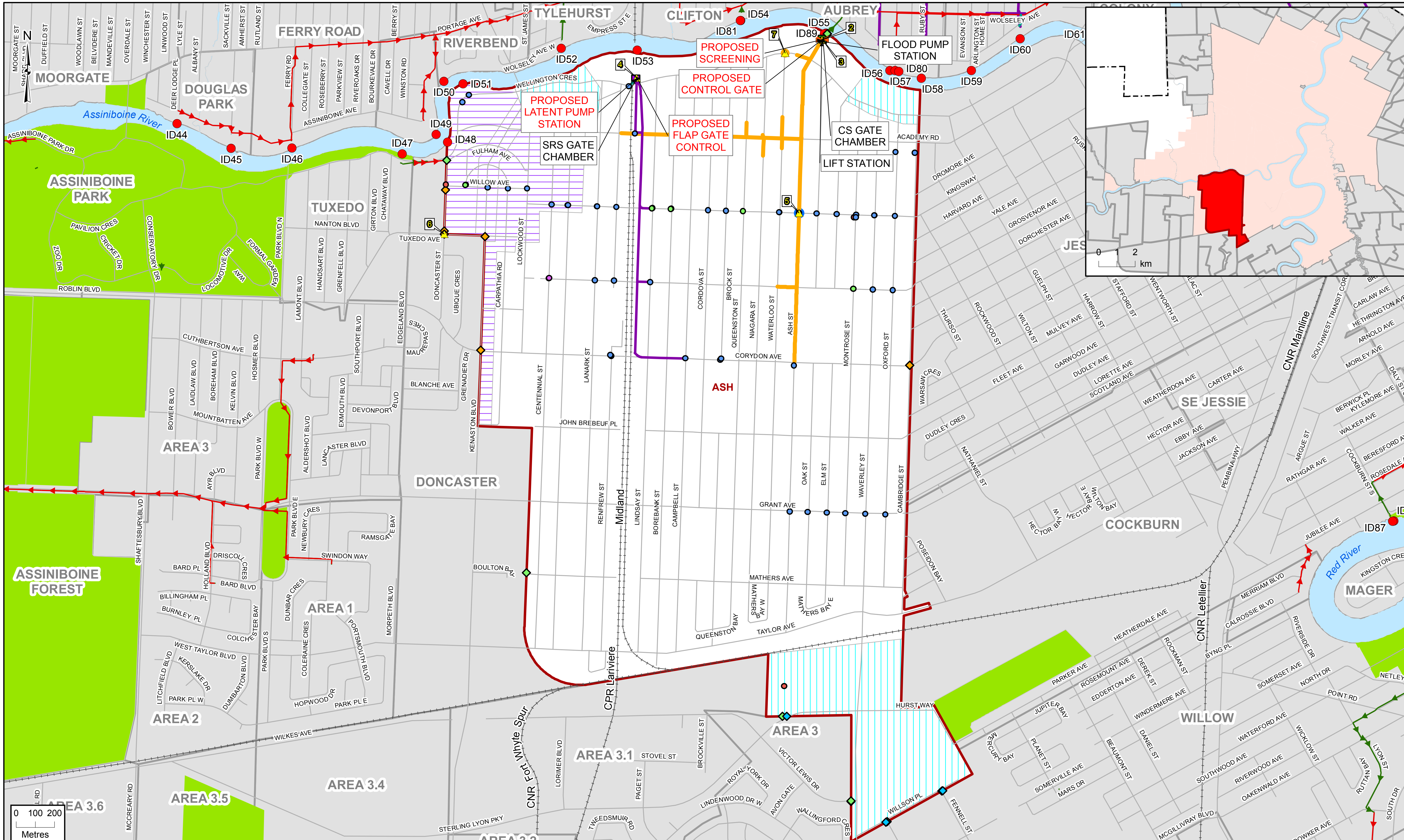
Risk Number	Risk Component	Latent Storage / Flap Gate Control	In-line Storage / Control Gate	Off-line Storage Tank	Off-line Storage Tunnel	Sewer Separation	Green Infrastructure	Real Time Control	Floatable Management
1	Basement Flooding Protection	R	R	-	-	O	-	-	-
2	Existing Lift Station	-	R	-	-	-	-	R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

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

1.12 References

City of Winnipeg. 2008. *Study Details, Route 90 Study*. Accessed July 10, 2018. http://www.winnipeg.ca/publicworks/construction/studies/route90-studyDetails.stm.

M.M. Dillon Ltd. 1981. *Ash District Combined Sewer Relief*. December.



LEGEND

Primary Weir	Inter-System Connection	District Boundary Crossing	Interceptor Sewer	District Boundary
Critical Elevation	CS - WWS	CS	Force Main	Watercourse
CSO Outfall	SRS - CS	LDS	Street	Greenspace
Low CS Manhole	SRS - LDS	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 - Planning
- Sewer Separation - Complete

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

JACOBS

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

Winnipeg

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

FIGURE 03
District Overview Map
Sewer District: Ash
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
- 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 03-01
Control Gate and Screening
Sewer District: Ash
City of Winnipeg
Combined Sewer Overflow Master Plan

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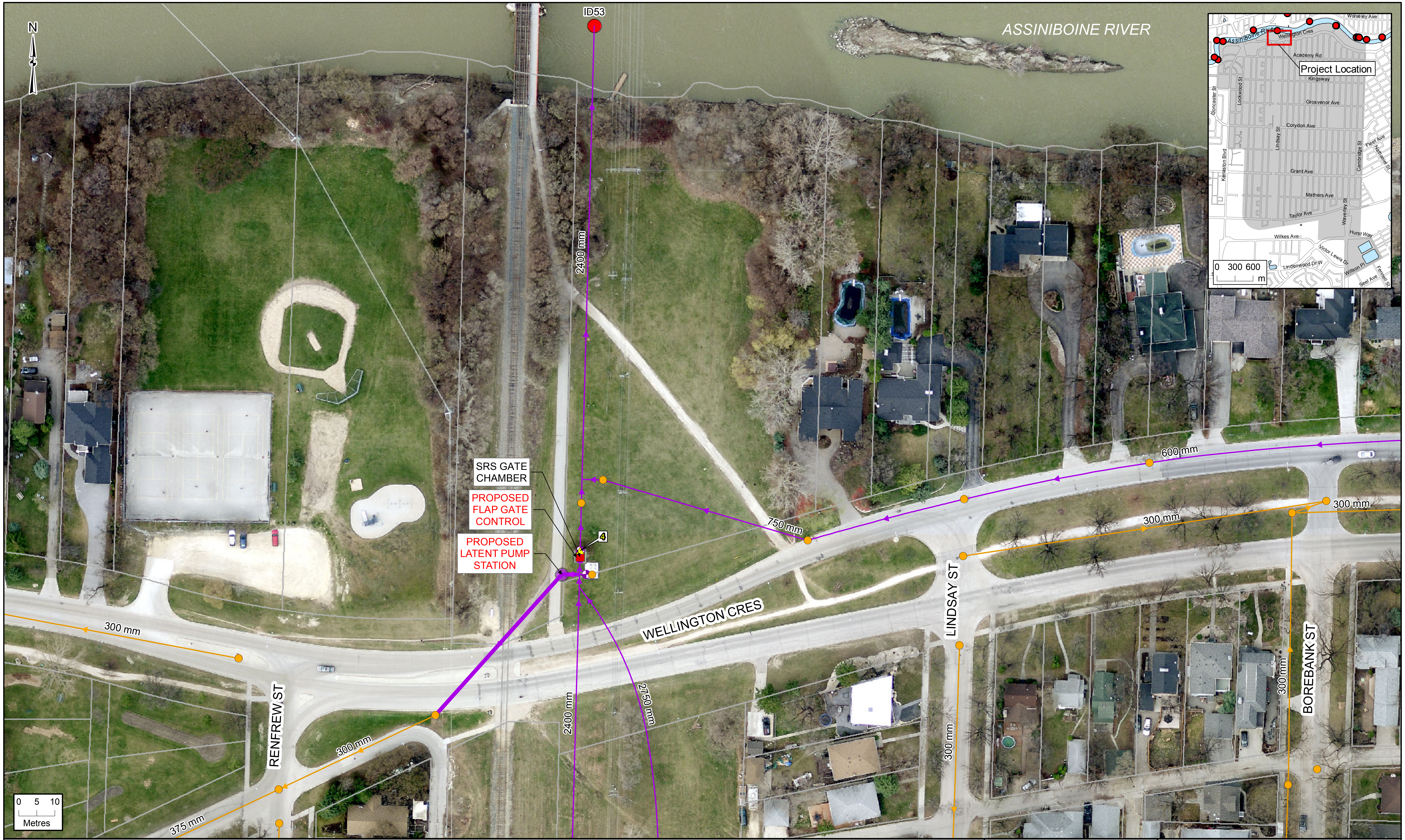

LEGEND

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

Sewer By Type
- CS
- SRS

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

JACOBS

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

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WATER AND WASTE DEPARTMENT

FIGURE 03-02
Latent SRS Control
Sewer District: Ash
City of Winnipeg
Combined Sewer Overflow Master Plan

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