CSO Master Plan

Mager District Plan

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City of Winnipeg

CSO Master Plan

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1. Mager District

1.1 District Description

Mager district is located at the southeast limit of the combined sewer (CS) area and is included within the South End Sewage Treatment Plant (SEWPPC) catchment area. Mager is bounded by the Red River to the west, Bethune Way, Bishop Grandin Boulevard, and Worthington Avenue to the South, Carriere Avenue to the north, and the Seine River forms the eastern border from Berrydale Avenue north to Carriere Avenue. Figure 24 provides an overview of the sewer district and the location of the proposed Combined Sewer Overflow (CSO) Master Plan control options.

St. Mary's Road and St. Anne's Road are two of the major transportation routes that travel through Mager. Fermor Avenue (Trans-Canada Highway), runs east-west through the central portion of the district. Most development within the district took place in the 1950s and 1960s, and little development has taken place since.

The Mager district is highly residential with greater than 60 percent made up of residential land use and less than 10 percent commercial land use. The commercial land use is concentrated along St. Mary's Road and St. Anne's Road. Other land use in the district is park space and schools, such as Saint Vital Memorial Park and Windsor School. Approximately 100 ha of the district is classified as greenspace which includes multiple parcels spread throughout the district.

1.2 Development

A portion of St. Mary's Road and St. Anne's Road are located within the Mager district. These streets are identified as Regional Mixed Use Corridors as part of the Our Winnipeg future development plans. As such, focused intensification along St. Mary's Road and St. Anne's Road is to be promoted in the future.

1.3 Existing Sewer System

Mager district is the largest of all the combined sewer (CS) districts with an area of 768 ha[1] based on the GIS district boundary data. The sewer system contains a mix of combined sewers and separate wastewater and land drainage sewers (LDS). As shown on Figure 24, approximately 70 percent (575 ha) of the CS in Mager district has been separated and approximately 3 percent (20 ha) of the CS in Mager district is considered separation ready. The northern and central portions of the district contain combined and separation ready sewers with the western, eastern, and southern areas consisting of a separate land drainage and wastewater sewer system.

Mager district includes a small remaining CS system, with piping installed in the 1950s and 1960s. The district has since been partially separated into separate land drainage sewer and wastewater sewer systems, with the central portion of the district remaining as a CS system. For a portion of this area the separated wastewater sewers connect back into the existing CS, and would be considered separation ready.

The CS system includes a flood pump station (FPS), CS lift station (LS), one CS outfall, all located at the northern end of Mager Drive off St. Mary's Road. There is one SRS outfall beneath the St. Vital Bridge off Kingston Row, There is also a force main river crossing beneath the St. Vital Bridge, carrying all intercepted CS from the Cockburn, Calrossie, and Baltimore districts. The intercepted CS from the upstream districts is discharged into the CS system for the Mager district, such that it is intercepted once more at the primary weir for the Mager district.

[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), all domestic wastewater and combined sewage flows collected in Mager district are routed to the St Mary's Road CS trunk and to the CS LS off Mager Drive. Sewage flows are directed by the primary weir to the Mager CS LS and pumped to the trunk sewer on St. Thomas Toad that flows to the interceptor on Bishop Grandin Boulevard. From Mager district, flows are transported in the South End Interceptor System to the SEWPCC.

During wet weather flow (WWF), any flows that exceeds the diversion capacity of the primary weir is discharged into the Mager outfall where it flows to the Red River by gravity. Sluice and flap gates are installed on the CS outfall to prevent back-up of the Red River into the CS system under high river level conditions. Under these high river level conditions the flap gate which restricts river level infiltration into the CS system will prevent gravity discharge through the Mager CS outfall. Excess flow trapped behind the flap gate is then pumped by the Mager FPS downstream of the flap gate through the CS outfall, where it will discharge by gravity to the Red River.

The Mager district includes large areas that include LDS and wastewater sewer (WWS) sewer networks, which as mentioned above are classified as partially separated. The LDS system as part of these separated areas includes 15 outfalls from the district to the Red River and Seine River, installed along the perimeter of the district. In these areas, catch basins connect storm weather to the LDS systems that direct flow to the specific LDS outfalls. The Pulberry LS is located on St Vital Road at the intersection of Pulberry Street, and services the wastewater sewers in southwest section of the separated area of the Mager district. The Pulberry LS lifts WW to the CS system on directly adjacent to the WWLS on St Vital Road 8 metres downstream.

The combined sewer outfalls to the Red River are as follows:

- ID04 (S-MA70007510) – Mager CS Outfall
- ID03 (S-MA50014591) – Mager SRS Outfall

1.3.1 District-to-District Interconnections

There are several district-to-district interconnections between Mager and the surrounding districts. There are no district boundary crossings though the Seine River to the east. Each interconnection location is shown on Figure 24 and is listed as follows:

1.3.1.1 Interceptor Connections – Upstream of Primary Weir

Baltimore

- The 450 mm Baltimore LS force main flows under pressure into Mager district at Kingston Row and Edinburgh Street:
  - Dunkirk Avenue force main at connection point to Mager CS – 226.56 m (S-MA50017754)

Metcalfe

- The 200 mm Metcalfe LS force main flows under pressure into the Mager district CS system:
  - St Mary's Road force main at connection point to Mager CS – 227.52 m (S-MA70017062)

1.3.1.2 Interceptor Connections – Downstream of Primary Weir

Area 18

- The Mager 1375 mm interceptor flows by gravity from Mager district into Area 18 and connects to the South Interceptor and onto the SEWPCC:
  - St. George Road Interceptor Invert at District Boundary – 224.36 m (S-MA50018680)

1.3.1.3 District Interconnection

Area 16

WWS to WWS

- A 250 mm WWS collecting wastewater from Hardy Bay and a 250 mm WWS from River Road overflow pipe within the Mager District flow into WW system in the Area 16 district:
  - River Road and Hardy Bay – 227.76 m (S-MA50014668)

LDS to LDS

- A 525 mm land drainage gravity sewer within River Road and Hardy Bay within the Mager District which does not interact with the Mager CS System flows into Area 16 and the nearby LDS outfall:
  - River Road LDS Invert at connecting LDS sewer- 228.08 m (S-MA50018409)

Area 17

WWS to WWS

- High point sewer manhole (flow is directed into both districts from this manhole):
  - 250 mm WWS on Bethune Way – 228.30 m (S-MH50011761)

LDS to LDS

- Gravity flows from the land drainage system in Area 17 into the LDS system in Mager district at multiple points. The LDS system in Mager as part of previous sewer separation work. This LDS flows directly to outfall to the Red River, however there is an SRS interconnection with the LDS network and WWS network at Parkville Bay and Parkville Drive
  - 750 mm LDS at Bethune Way and Glen Meadow Street, LDS Invert at District Boundary – 228.76 m (S-MA50014745)
  - 600 mm LDS at Pulberry Street, LDS Invert at District Boundary – 229.20 m (S-MA50015276)
- Gravity flow from the land drainage system in Mager district, servicing part of Bethune way and a three block stretch of St. Mary's Road flows into LDS system within the separated Area 17. This does not interconnect with the Mager CS system:
  - St. Mary's Road at Bishop Grandin LDS Invert at District Boundary – 228.70 m (S-MA50015300)

Area 18

WWS to WWS

- High point sewer manhole (flow is directed into both districts from this manhole):
  - 250 mm at Dakota Street and Chesterfield Avenue – 226.28 m (S-MH50015058)
  - 250 mm at Marlene Street – 226.75 m (S-MH50015034)

LDS to LDS

- A 900 mm LDS flows westbound on Beliveau Road from Area 18 and connects to the LDS network in Mager. This does not interconnect with the Mager CS system:
  - Beliveau Road LDS Invert at District Boundary – 227.73 m (S-MA50018013)

Marion

LDS to LDS

- A 525 mm LDS servicing a short stretch of Carriere within Marion district flows into the LDS system in Mager district and directly to outfall. There is no interaction with Mager CS system

– Youville Street LDS Invert at District Boundary – 227.17 m (S-MA70001110)

A district interconnection schematic is included as

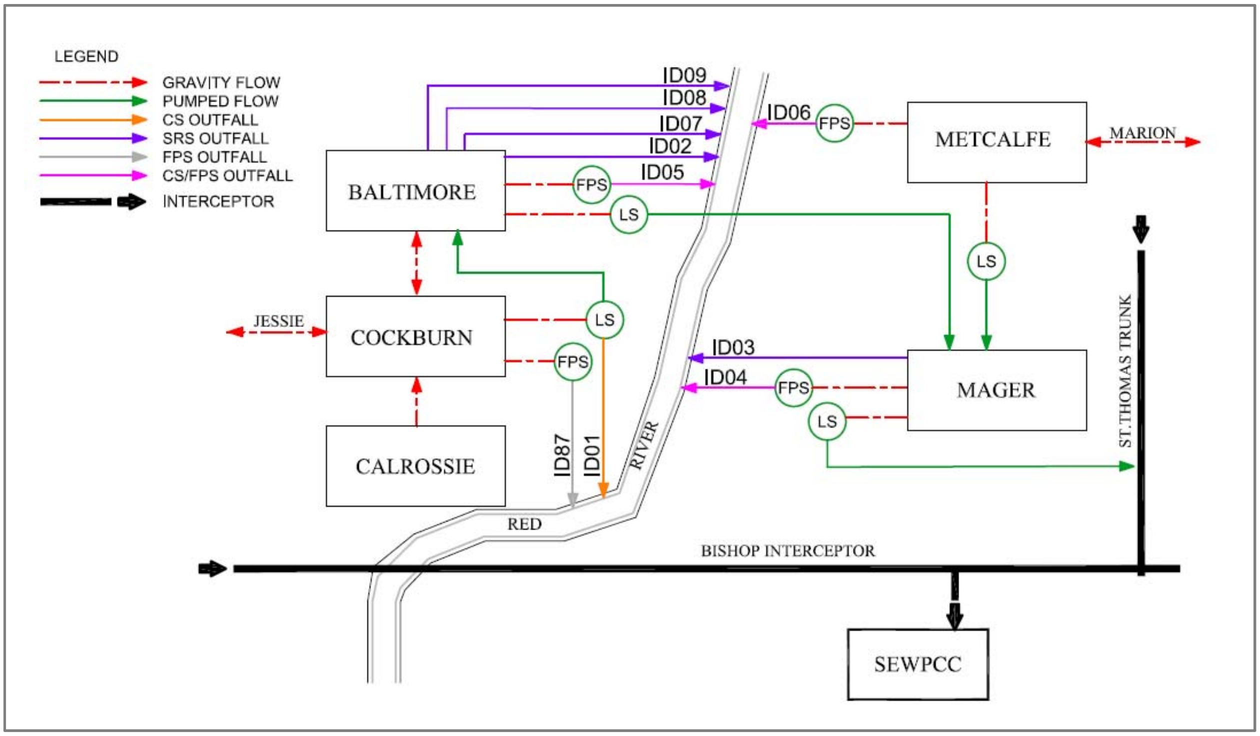


Figure 1-1. The drawing illustrates the collection areas, interconnections, pumping systems, and discharge points for the existing district.

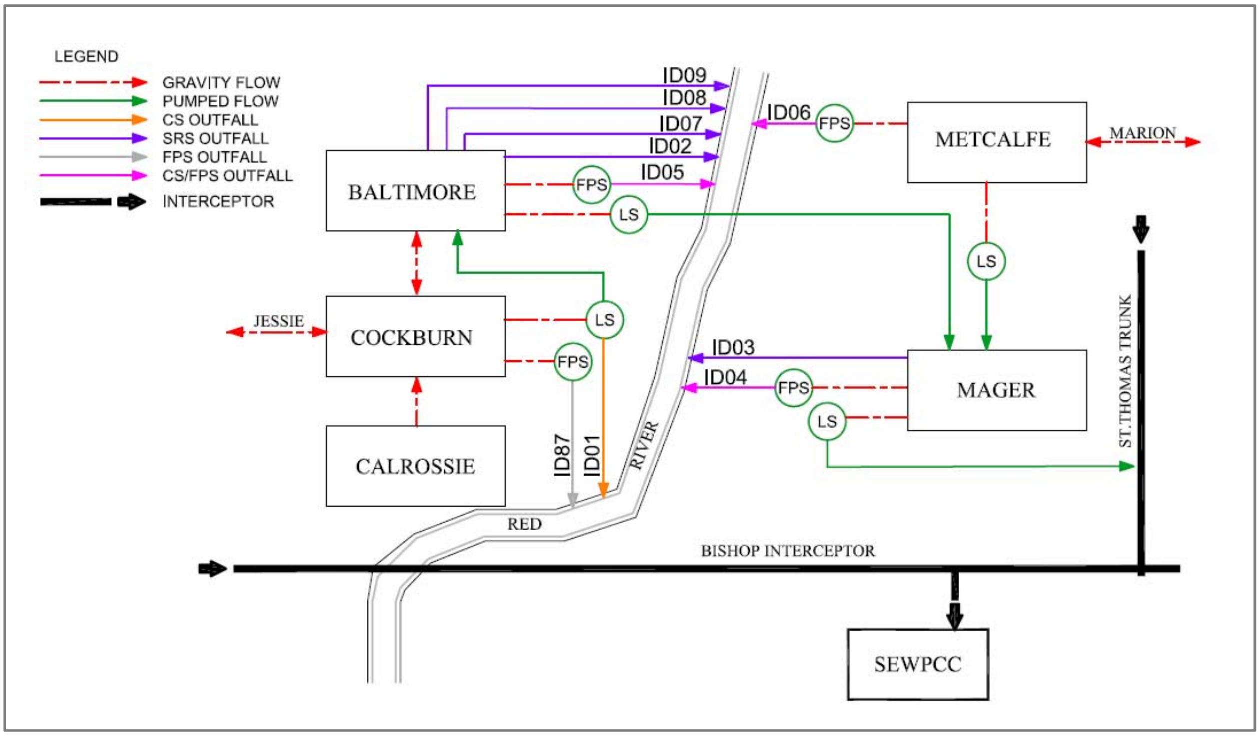


Figure 1-1. District Interconnection Schematic

1.3.2 Asset Information

The main sewer system features for the district are shown on Figure 24 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 (ID4)	S-YY70021073.1	S-MA70007510	1660 mm	Circular Invert: 221.72 m
Flood Pumping Outfall (ID4)	S-YY70021073.1	S-MA70007510	1660 mm	Circular Invert: 221.72 m
Other Overflows	N/A	N/A	N/A	N/A
Main Trunk	S-MH50012525.1	S-MA70018393	2250 x 3375 mm	Egg-shaped Invert: 223.92 m
SRS Outfalls (ID3)	S-CO50003092.1	S-MA50014591	800 mm	Circular Invert: 222.60 m
SRS Interconnections	S-MH50011684.1S-MH70003108.1 S-MH70003109.1S-TE70002942.1 N/A N/A	S-MH50011684 S-MH70003108 S-MH70003109 S-TE70002942	N/A N/A N/A N/A	Invert: 226.51 m Invert: 227.88 m Invert: 228.43 m Invert: 227.25 m
Main Trunk Flap Gate	S-TE70027658.2	S-CG00001114	2000 mm	Invert: 224.22 m
Main Trunk Sluice Gate	Mager Gate.1	S-CG00001115	2000 x 2000 mm	Invert: 224.15 m
Off-Take	S-TE70024868.2	S-MA70068576	450 mm	To lift station Invert: 223.92
Dry Well	N/A	N/A	N/A	No dry well associated with Mager LS
Lift Station Total Capacity	N/A	N/A	0.517 m^3/s	2 pumps @ 0.315 m^3/s, and

Table 1-1. Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
				0.202 m^3/s
Lift Station ADWF	N/A	N/A	0.095 m^3/s	
Lift Station Force Main	S-TE70027636.1	S-MA70007687	600 mm	Invert: 227.91
Flood Pump Station Total Capacity	N/A	N/A	Minimum - 1.71 m^3/s Maximum - 2.15 m^3/s	Minimum - 0.58, 1.13 m^3/s for each pump Maximum - 0.71, 1.44 m^3/s for each pump
Pass Forward Flow – First Overflow	N/A	N/A	0.477 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	Kingston Row – 223.75 Mager Drive – 223.75
2	Trunk Invert at Off-Take	223.92
3	Top of Weir	224.95
4	Relief Outfall Invert Immediately Upstream of Gate Chamber	225.20
5	Relief Interconnection (S-MH50011684)	226.51
6	Sewer District Interconnection (Area 18)	226.28
7	Low Basement (Mager)	226.70
8	Flood Protection Level (Mager)	230.04

[a] City of Winnipeg Data, 2013

1.4 Previous Investment Work

A stormwater management study (I.D. Engineering, 1992) was completed for Mager district in 1992. The study described the potential of implementing relief alternatives and recommended an alternative to meet the 1 in 5-year and 1 in 10-year level of service for basement flooding. A portion of the Mager district was separated, but the entire district was not completed with the most recent construction in 2011. Table 1-3 provides a summary of the district status in terms of data capture and study.

Table 1-3. District Status

District	Most Recent Study	Flow Monitoring	Hydraulic Model	Status	Expected Completion
Mager	1992	Future Work	2013	Partially Separated	N/A

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 Mager Combined Sewer District was included as part of this program. Instruments installed at each of the

39 primary CSO outfall locations have a combination of inflow and overflow level meters and flap gate inclinometers if available.

1.5 Ongoing Investment Work

There is ongoing maintenance and calibration of the permanent instruments installed within the primary outfall within the Mager 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 Mager sewer district are listed in Table 1-4. The proposed CSO control projects will include in-line storage via a control gate and 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 system is suitable for use as in-line storage. This control option will take advantage of the existing CS pipe network for additional storage volume.

The primary outfall location in the Mager district is to be screened under the current CSO control plan. Installation of a control gate will be required for the screen operation, and it will 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 In-Line Storage

In-line storage has been proposed as a CSO control for the Mager district. The in-line storage will require the installation of a control gate at the CS outfall. The gate will increase the storage level in the existing CS to provide an overall higher volume capture. The control gate will also provide the additional hydraulic head necessary for screening operations.

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

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

Item	Elevation/Dimension	Comment
Invert Elevation	223.92 m	
Trunk Diameter	2250 x 3375 mm	Egg-shaped
Gate Height	0.76 m	Gate height based on half trunk diameter assumption
Top of Gate Elevation	225.71 m	
Bypass Weir Height	225.51 m	
Maximum Storage Volume	3,450 m^3	
Nominal Dewatering Rate	0. 517 m^3/s	Based on existing CS LS capacity
RTC Operational Rate	TBD	Future RTC / dewatering review on performance

Note:
TBD – to be determined

RTC – Real Time Control

The proposed control gate will cause combined sewage to back-up in the collection system to the extent shown on Figure 24. The extent of the in-line storage and volume is related to the elevation of the bypass 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 CS system are reduced following wet weather events, below the bypass side weir critical performance level. the control gate moves back to its original position to provide additional in-line storage capture for future wet weather events. 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 providing during a WWF event as downstream capacity becomes available.

Figure 24-01 provides an overview of the conceptual location and configuration of the control gate, bypass side 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 5.5 m in length and 4.0 m in width to accommodate the gate, with an allowance for a longitudinal overflow weir. Further optimization of the gate chamber size may be provided if a decision is made not to include screening. 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 Mager 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 work required for the control gate construction is located within a residential street with minor disruptions expected.

The physical requirements for the existing 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 set at the existing CS LS capacity. The dewatering rate includes both the DWF and WWF components of the district flows. This allows dewatering through the existing interceptor system within 24 hours following the runoff event, allowing it to recover in time for a subsequent event. Any future considerations, for RTC improvements, would be completed with spatial rainfall as any reduction to the existing capacity for large events will adversely affect the overflows at this district. This future RTC will provide the ability to capture and treat more volume for localized storms by using the either the district in-line storage or the excess interceptor capacity where the runoff volume is less. Further assessment of the impact of the RTC and future dewatering arrangement will be necessary to review the downstream impacts.

1.6.3 Floatables Management

Floatables management will require installation of a screening system to capture floatable materials. 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 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 1-6.

Table 1-6. Floatables Management Conceptual Design Criteria

Item	Elevation/Dimension/Rate	Comment
Top of Gate	225.71 m	
Bypass Weir Crest	225.51	
Normal Summer River Level	223.75 m	
Maximum Screen Head	1.76 m	
Peak Screening Rate	0.196 m^3/s	
Screen Size	1 m high x 1.5 m wide	Modelled Screen Size

The proposed bypass side weir and screening chamber will be located adjacent to the proposed control gate and existing CS trunk, as shown on Figure 24-01. The screens will operate with the control gate in its fully raised position., diverting flows to the bypass weir. 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 screening chamber will include screenings pumps with a discharge returning the screened material to the CS LS for routing to the SEWPCC for removal.

The dimensions for the screen chamber to accommodate influent from the side weir, the screen area, and the routing of the discharge piping downstream of the gate are 3.0 m in length and 3.5 m in width. The existing sewer configuration including the 2250 mm by 3375 mm sewer trunk and the 450 mm off-take may have to be modified to accommodate the new chamber.

1.6.4 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 the most applicable GI controls.

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

1.6.5 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 may require the addition of a new chamber and a moving gate at the outfall. In-line storage dewatering will be controlled with the existing CS LS which will require more frequent and longer duration pump run times. Lower velocities in the CS trunks may create additional debris deposition and require more frequent 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. Additional maintenance for the pumps will be required at regular intervals in line with typical lift station maintenance and after significant screening events.

1.8 Performance Estimate

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

Table 1-7. InfoWorks CS District Model Data

Model Version	Total Area (ha)	Contributing Area (ha)	Population	% Impervious	Control Options Included in Model
2013 Baseline	743	743	21,429	5	N/A
2037 Master Plan – Control Option 1	743	743	21,429	5	IS, SC

Notes:

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

Table 1-8. Performance Summary – Control Option 1

	Preliminary Proposal	Master Plan			
Control Option	Annual Overflow Volume (m^3)	Annual Overflow Volume (m^3)	Overflow Reduction (m^3)	Number of Overflows	Pass Forward Flow at First Overflow [a]
Baseline (2013)	22,652	21,912	-	18	0.477 m^3/s
In-Line Storage	5,989	1,056	20,856	2	0.517 m^3/s
Control Option 1	**5,989**	**1,056**	**20,856**	**2**	**0.517 m^3/s**

Note:
[a] Pass forward flows assessed on the 1-year (baseline) and 5-year (CO1) design rainfall events

It is possible that volume capture improvement in this district is due to a combination of the reduction in flows from the upstream pumping stations and the provision of the in-line storage control option at the Mager CS LS. However, no change to the peak pumped flows from the upstream districts of Baltimore and Metcalfe was noted from the implementation of in-line storage within the Mager district. This would indicate that the in-line storage component within Mager alone provides the majority of the modelled overflow volume reduction. The percent capture performance measure is not included in Table 1-8, as it is applicable to the entire CS system and not for each district individually.

1.9 Cost Estimates

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

Table 1-9. Cost Estimates – Control Option 1

Control Option	2014 Preliminary Proposal Capital Cost	2019 CSO Master Plan Capital Cost	2019 Annual Operations and Maintenance Cost	2019 Total Operations and Maintenance Cost (Over 35-year period)
In-line Control Gate	$7,740,000	$2,710,000 [b]	$41,000	$880,000
Screening		$1,590,000 [c]	$30,000	$640,000
Subtotal	**$7,740,000**	**$4,300,000**	**$71,000**	**$1,520,000**
Opportunities	N/A	$430,000	$7,000	$150,000
District Total	**$7,740,000** [a]	**$4,730,000**	**$78,000**	**$1,670,000**

[a] Solution development as refinement to Preliminary Proposal costs, refined shortly after Preliminary Proposal submission. Revised costs for the control gate and screening work found to be $1,910,000 in 2014 dollars.

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

[c] Cost for bespoke screenings return pump/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 costs for RTC. This has been listed as part of the Opportunities costs.
- The Preliminary Proposal capital cost is in 2014 dollar values.
- The CSO Master Plan capital cost is based on the control options presented in this plan and in 2019 dollar values.
- The 2019 Total Annual Operations and Maintenance (over 35-year period) cost component is the present value costs of each annual O&M cost under the assumption that each control option was initiated in 2019.
- The 2019 Annual Operations and Maintenance Costs were based on the estimated additional O&M costs annually for each control option in 2019 dollars.
- Future costs will be inflated to the year of construction.

Cost estimates were prepared during the development of the Preliminary Proposal and updated for Phase 3 during the CSO Master plan development. The differences identified between the Preliminary Proposal and the CSO Master Plan are accounting for the progression from an initial estimate used to compare a series of control options, to an estimate focusing on a specific level of control for each district. Any significant differences between the Preliminary Proposal and CSO Master Plan estimates are identified in Table 1-10.

Table 1-10. Cost Estimate Tracking Table

Changed Item	Change	Reason	Comments
Control Options	Control Gate	Unit cost updates Separation of screening and in-line	In-line and Screening included as combined cost in Preliminary Proposal
	Screening	Unit cost updates Separation of screening and in-line	In-line and Screening included as combined cost in Preliminary Proposal
Opportunities	A fixed allowance of 10 percent has been included for program opportunities	Preliminary Proposal estimate did not include a cost for GI opportunities	
Lifecycle Cost	The lifecycle costs have been adjusted to 35 years	City of Winnipeg Asset Management approach.	
Cost escalation from 2014 to 2019	Capital Costs have been inflated to 2019 values based on an assumed value of 3 percent per for construction inflation.	Preliminary Proposal estimates were based on 2014 dollar values.	

1.10 Meeting Future Performance Targets

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

Overall the Mager district would be classified as a low potential for implementation of complete sewer separation as the feasible approach to achieve the 98 percent capture in the representative year future performance target. The favorable performance and additional volume capture potentially available via control gate construction and in-line storage utilization was found to not require any additional measures to within this district to address future performance targets. The existing extent of sewer separation within the district has also been found to sufficient as is to meet future performance targets. Additional opportunistic separation of the portions of the district would still be recommended however, so long as there are sufficient synergies and cost savings with other major infrastructure work. In addition, focused use of green infrastructure could also be utilized to meet future performance targets.

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

Upgrade Option	Viable Migration Options
98 Percent Capture in a Representative Year	• Opportunistic additional sewer separation • Increased use of GI • Increased use of In-line

The control options for the Mager district have been aligned for the 85 percent capture performance target. The expandability of this district to meet the 98 percent capture would again involve a system wide basis analysis to be completed to determine the next phase for the district. As noted in the performance summary, this district already achieves a high level of percent capture and is impacted from the upstream districts that discharge to the Mager district. Any increases to the districts percent capture would be to eliminate overflows from this district or improve the system-wide percent capture overall target.

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

1.11 Risks and Opportunities

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

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

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

ID Number	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	-	-	-	-	-	-

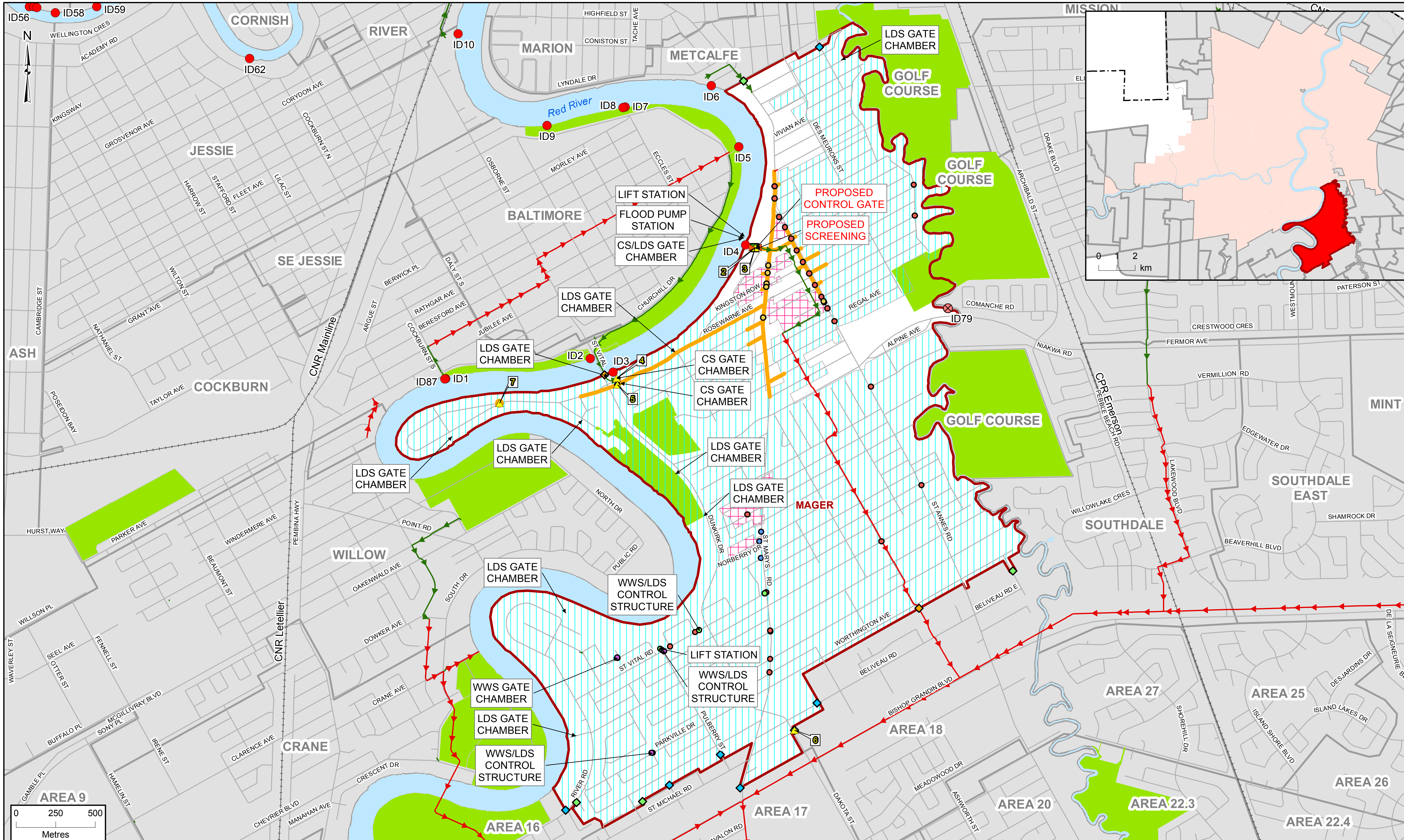
Table 1-12. Control Option 1 Significant Risks and Opportunities

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

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

1.12 References

I.D. Engineering Canada Inc. 1992. *Sewer Relief Study Mager Combined Sewer District*. Prepared for the City of Winnipeg, Waterworks, waste and disposal department. October.



LEGEND

- Primary Weir
- Critical Elevation
- Decommissioned Outfall
- CSO Outfall
- Low CS Manhole

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

District Boundary Crossing
- CS
- LDS
- WWS

- Interceptor Sewer
- Force Main
- Street
- Railway
- District Boundary
- Watercourse
- Greenspace

CSO MASTER PLAN PROPOSED SOLUTIONS

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

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 24
District Overview Map
Sewer District: Mager
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
  - LDS
- Pump Station Type
  - Flood Pump Station
  - Lift Station

CSO MASTER PLAN PROPOSED SOLUTIONS

- Control Gate
- Screening

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

JACOBS

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

Winnipeg
THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

FIGURE 24-01
Control Gate and Screening
Sewer District: Mager
City of Winnipeg
Combined Sewer Overflow Master Plan

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