CSO Master Plan

Dumoulin District Plan

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City of Winnipeg

CSO Master Plan

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2	06/2019	Final Draft Submission	DT	MF	MF
3	08/19/2019	Final Submission For CSO Master Plan	MF	MF	SG

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1. Dumoulin District

1.1 District Description

Dumoulin district is located near the centre of the combined sewer (CS) area. Dumoulin is bounded by Mission district to the east, Despins district to the south and west, La Verendrye district to the north, and the Red River to the west. Dumoulin Street forms the northern boundary, De La Cathedrale the southern boundary, the Red River the western boundary, and the Seine River the eastern boundary.

The regional transportation routes that pass through Dumoulin district are Provencher Boulevard, Taché Avenue, and Des Meurons Street. Provencher Boulevard runs east-west and crosses the Red River and connects from the St. Boniface area to downtown. Taché Avenue runs parallel to the Red River and connects Marion Street to Provencher Boulevard, providing access to the St. Boniface Hospital. The Canadian National Railway Sprague rail line passes through the northeastern section of the Dumoulin district.

This district includes residential, with commercial areas located along the Provencher Boulevard and Des Meurons corridors. A small area of industrial land use with light and general manufacturing is located in the eastern portion of the district. The residential land use areas contain an distribution of multi-family, single-family, and two-family homes. Numerous institutional facilities are located in this district including St. Boniface University and College Louis-Riel. Other significant properties include the St. Boniface Cathedral, and Provencher Park, which encompass a large area in the centre of the district. Approximately 10 ha of the district is classified as greenspace.

1.2 Development

Provencher Boulevard, which is recognized as a Mixed Used Corridor within OurWinnipeg and will be promoted for future development and densification.

Provencher Boulevard has also been identified as one of the potential routes for the Eastern Corridor of Winnipeg's Bus Rapid Transit. This could result in additional development in the area. This could also present an opportunity to coordinate sewer separation works alongside the transit corridor development, providing further separation within the Dumoulin district. This would reduce the extent of the Control Options listed in this plan required.

1.3 Existing Sewer System

Dumoulin district encompasses an area of 70 ha[1] based on the district boundary and includes combined sewer (CS), wastewater sewer (WWS), and land drainage sewer (LDS) systems. As shown in Figure 15, there is approximately 38 percent (27 ha) separated and no separation-ready areas.

The Dumoulin sewer system includes a diversion chamber, a dual lift and flood pump station (LFPS), a flood pump station (FPS) outfall, and a CS outfall with gate chamber located adjacent to the Red River at Tache Avenue and Dumoulin Street. Sewage flows collected in the Dumoulin district converge to a 1050 mm CS trunk flowing west on Dumoulin Street and a 450 mm CS trunk sewer flowing west on Provencher Boulevard and drain towards the outfall. The two CS trunks meet at the intersection of Taché Avenue and Dumoulin Street. Intercepted CS from the La Verendrye district also enters Dumoulin district, from either a 300 mm pipe offtake pipe or a 450 mm overflow pipe. Each of these interconnections with the La Verendrye district flow south along Tache Avenue to tie into the Dumoulin CS trunk upstream of the district primary weir.

[1] City of Winnipeg GIS information relied upon from 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 Dumoulin primary weir diverts flow to the lift station section of the Dumoulin LFPS through a 300 mm off-take pipe. The Dumoulin LFPS pumps the flow south down Tache Avenue through a 350 mm force main, and across the Red River into the Bannatyne district and on to the North End Sewage Treatment Plant (NEWPCC). The river crossing from the Despins district is located adjacent to this Dumoulin river crossing, with interconnection valves installed between the two river crossings. During normal operations however these valves remains closed and there is no interaction between the two river crossings.

During wet weather flow (WWF) events, any flows that exceed the diversion capacity overtop the primary weir and are discharged to the Red River via the CS outfall structure. A flap and sluice gate are in place on the CS outfall to prevent the Red River from back flowing into the CS under high river level conditions. When river levels are high such this however the flap gate prevents gravity flow discharge from the CS outfall. Under these conditions the FPS pumps from the Dumoulin LFPS collect the excess CS trapped behind the outfall flap gate, and pump the flow to an elevated discharge box. The discharge box then allows flow by gravity into the Red River through a dedicated FPS outfall which contains no positive or flap gate.

Three independent LDS systems with outfalls collect the surface runoff and discharge to the adjacent rivers. Runoff from the southeast portion of the district (mainly from Despins district) flows to a 600 mm LDS outfall on Bourgeault Street and discharges to the Seine River. A 1050 mm LDS along De La Cathedrale Avenue collects runoff from the southern extents of the Dumoulin district. This LDS trunk crosses Taché Avenue in the Despins district and discharges to the Red River via a 1200 mm LDS outfall. Each LDS outfall includes a sluice and flap gate to prevent river water from backing up into the system.

The two outfalls (one CS and one FPS) to the Red River are listed as follows:

- ID14 (S-MA70047759) – Dumoulin CS Outfall
- ID84 (S-MA70016522) – Dumoulin FPS Outfall

1.3.1 District-to-District Interconnections

There are several district-to-district interconnections between Dumoulin and the surrounding districts. Each interconnection is shown on Figure 15 and shows locations where gravity and pumped flow can cross from one district to another. Each interconnection is listed as follows:

1.3.1.1 Interceptor Connections

No interceptor connections

1.3.1.2 District Interconnections

Despins

<u>WWS to WWS</u>

- A 350 mm force main carries intercepted flow from the Dumoulin LFPS to the Despins district. Within the Despins district the CS then crosses the Red River via river crossing, and on to the North End Sewage Treatment Plant (NEWPCC) for treatment:
  - Bannatyne district east of Main Street invert – 227.52 m (S-MH70021611)

<u>CS to CS</u>

- Common high point sewer manholes:
  - Desautels Street and Des Meurons Street invert – 228.38 m (S-MH50008956)
  - Bourgeault Street and Desautels Street invert – 229.44 m (S-MH50008651)

- Ritchot Avenue and Hamel Avenue invert – 228.85 m (S-MH50002546)

- A 750 mm by 1150 mm CS pipe from Despins CS system flows by gravity westbound on Hamel Avenue and connects to an overflow CS pipe that flows northbound on Langevin Street into the CS system in Dumoulin district:
  - Hamel Avenue and Lavgevin Street invert – 228.63 m (S-MH50002548)
- A 750 mm by 1150 mm CS pipe from Despins CS system flows westbound on Hamel Avenue and connects to an overflow CS pipe that flows northbound on St Jean Baptiste Street into the CS system in Dumoulin district:
  - Hamel Avenue and St. Jean Baptiste Street invert – 228.80 m (S-MH50002313
- A 750 mm CS pipe from the Dumoulin CS system flows by gravity southbound on De La Morenie Street and connects to the CS system in Despins district:
  - Cathedrale Street and De La Morenie Street Invert – 226.38 m (S-MH50008928)

<u>LDS to LDS</u>

- A 300 mm LDS pipe from Despins district LDS system flows by gravity northbound on Des Meurons Street and connects to the LDS system in Dumoulin district.
  - Desautels Street and Des Meurons Street invert into 375 LDS – 226.45 m (S-MH50008203)
- A 450 mm LDS pipe from Dumoulin district LDS system flows by gravity westbound on Desautels Street and connects to the LDS system Despins district where it flows back out into Dumoulin to be discharged into the Seine River.
  - Bourgeault Street and Desautels Street Invert (into Despins) – 225.73 m (S-MH70008209)
  - Bourgeault Street and Desautels Street Invert (into Dumoulin) – 225.70 m (S-MA70008215)

La Verendrye

<u>CS to CS</u>

- A 300 mm CS pipe carries the intercepted CS diverted by the primary weir from the La Verendrye district, and flows by gravity southbound on Tache Avenue and connects to the CS system in the Dumoulin district.
  - Tache Avenue and Dumoulin Street invert – 222.53 m (S-MH50008804)
- A 450 mm CS high overflow pipe diverts CS from the La Varendrye trunk sewer upstream of the primary weir, and flows by gravity southbound on Tache Avenue and connects to the CS system in the Dumoulin district.
  - Tache Avenue and Dumoulin Street invert – 225.49 m (S-MH50004016)

<u>WWS to CS</u>

- A 600 mm WWS pipe from La Verendrye flows by gravity southbound on Langevin Street and connects into the CS system in Dumoulin district.
  - Langevin Street and Dumoulin district boundary invert – 226.77 m (S-MH-50003890)

<u>LDS to LDS</u>

- A 600 mm LDS pipe from Dumoulin district flows by gravity northbound into La Verendrye district at the intersection of Thibault Street and Dumoulin Street and is discharged into the outfall at the Seine River and does not interact with the CS system.
  - Thibault Street and Dumoulin Street at district boundary invert - 227.19 m (S-MH50004223)

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.

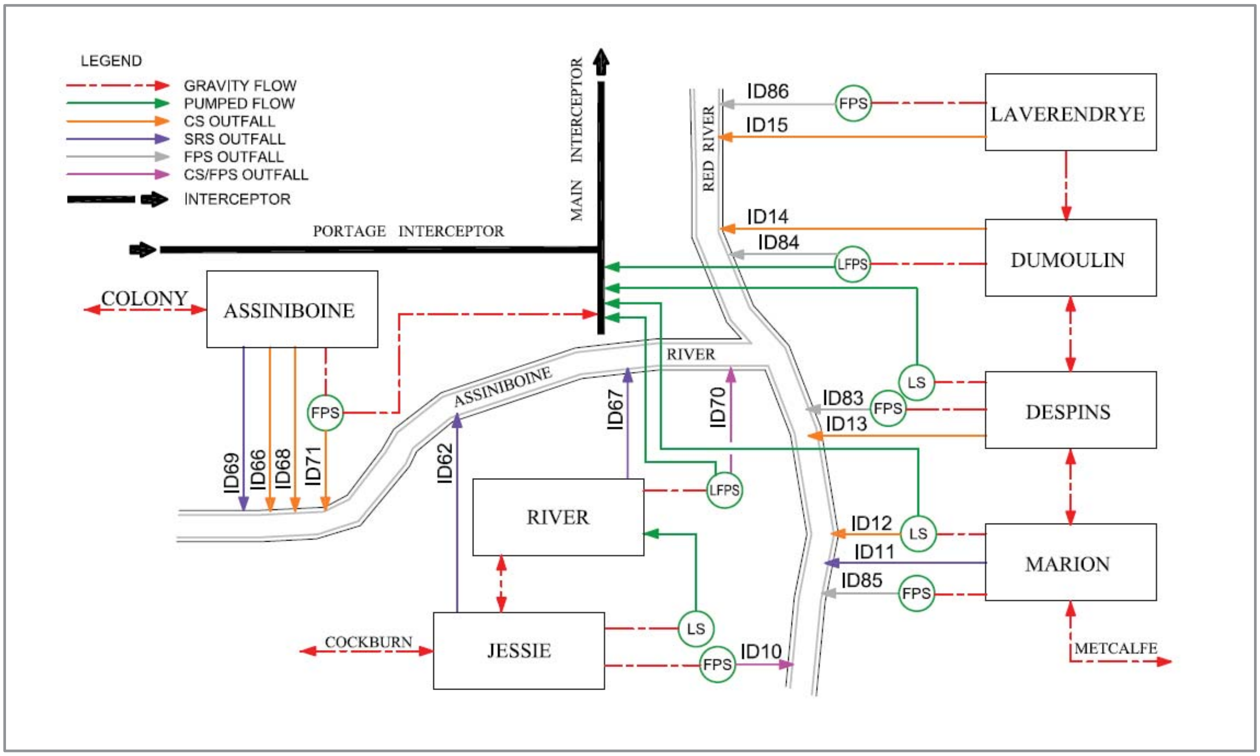


Figure 1-1. District Interconnection Schematic

1.3.2 Asset Information

The main sewer system features for the district are shown on Figure 15 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 (ID14)	S-CO70023242.1	S-MA70047759	1050 mm	Red River Invert: 222.70 m
Flood Pumping Outfall (ID84)	S-AC70007576.1	S-MA70016522	1200 mm	Red River Invert: 225.30 m
Other Overflows	N/A	N/A	N/A	
Main Trunk	N/A	S-MA70017914	1050 mm	Invert: 225.19 m
SRS Outfalls	N/A	N/A	N/A	No SRS within the Dumoulin district.
SRS Interconnections	N/A	N/A	N/A	No SRS within the Dumoulin district.
Main Trunk Flap Gate	S-CG00000787.1	S-CG00000786	1350 mm	Invert: 224.38 m
Main Trunk Sluice Gate	S-AC70008153.1	S-CG00000787	1200 x 1200 mm	Invert: 224.15 m
Off-Take	S-MH50008801.2	S-MA70017598	300 mm	Circular Invert: 224.73 m

Table 1-1. Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
Dry Well	N/A	N/A	N/A	No dry well arrangement within the LFPS.
Lift Station Total Capacity[1]	N/A	N/A	0.15 m^3/s	2 x 0.075 m^3/s
Lift Station ADWF	N/A	N/A	0.036 m^3/s	
Lift Station Force Main	S-BE70008151.1	S-MA70017614	350 mm	Invert: 226.60 m
Flood Pump Station Total Capacity	N/A	N/A	1.77 m^3/s	1 x 0.59 m^3/s, 1 x 1.18 m^3/s
Pass Forward Flow – First Overflow	N/A	0.178 m^3/s	N/A	

Notes:

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

[1]Lift Station pump capacity will need to be verified from flow monitoring.

The critical system elevations for the existing system relevant to the development of the Combined Sewer Overflow (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	Dumoulin – 223.73
2	Trunk Invert at Off-Take	224.85
3	Top of Weir	225.02
4	Relief Outfall Invert At Flap Gate	N/A
5	Low Relief Interconnection	N/A
6	Sewer District Interconnection (La Verendrye district boundary)	222.53
7	Low Basement	228.75
8	Flood Protection Level	229.72

[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 Dumoulin district was the *Dumoulin and La Verendrye Districts Combined Sewer Relief Study* (Wardrop, 2006). This report led to the construction of relief works for the existing CS systems to alleviate basement flooding. The CS district relief was completed at the same time for both Dumoulin and La Verendrye districts from 2002 to 2004. No other sewer work has been completed since that time.

Between 2009 and 2015, the City invested $12 million in the CSO Outfall Monitoring Program. The program was initiated to permanently install instruments in the primary CSO outfalls. The outfall from the Dumoulin 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
15 - Dumoulin	2006 - Conceptual	Future Work	2013	Study Complete	N/A

1.5 Ongoing Investment Work

There is no current or proposed CSO or sewer relief investment work occurring within Dumoulin district.

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

1.6 Control Option 1 Projects

1.6.1 Project Selection

The Dumoulin district has in-line and floatable control projects proposed to meet CSO Control Option 1. Table 1-4 provides an overview of the control options to be included in the 85 percent capture in a representative year option. 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 systems are suitable for use as in-line storage. These options would take advantage of the existing pipe networks for additional storage volume. Existing DWF from the collection system would remain the same, and overall district operations would remain the same.

Floatable control will be necessary to capture any undesirable floatables in the sewage. Floatables will be captured with all implemented control options to some extent, but screening may be added as required to reach the desired capture level. Installation of a control gate will be also required for the screen operation, in addition to providing the mechanism for capture of the 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 Dumoulin 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, primarily during low to moderate rainfall events. The control gate installation also provides the additional hydraulic head necessary for screening operations. It should be noted that for more severe rainfall events the control gate will no longer increase the storage levels in the existing CS, allowing the system to maintain the level of basement flooding protection.

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	225.19 m	
Trunk Diameter	1050 mm	
Gate Height	0.80 m	Gate height based on half trunk height assumption
Top of Gate Elevation	225.82 m	
Bypass Weir Elevation	225.70 m	
Maximum Storage Volume	109 m^3	
Nominal Dewatering Rate	0.15 m^3/s	Based on capacity of existing CS LS
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 within the collection system to the extent shown on Figure 15. The extent of the in-line storage and volume is related to the top elevation of the bypass weir. The level 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 raised 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 15-01 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 LFPS. The dimensions of the chamber to accommodate the bottom pivoting gate and an allowance for a side weir for floatables control are 5.3 m in length and 2.3 m in width, with an allowance for a longitudinal overflow weir. The existing sewer configuration including the construction of an additional off-take, and force main modifications may have to be completed accommodate the new chamber. This will be confirmed in future design assessments.

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 LS rehabilitation or replacement project. The control gate is proposed to be constructed within the existing lands the LFPS is located; therefore, minor disruptions are expected.

The nominal rate for dewatering is set at the capacity of the existing CS LS. This accommodates 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 pipe capacity/operation for large events will adversely affect the overflows at this district. Similar basis for the rate matching the lift station philosophy of two times nominal dewatering rate would be adopted. 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.

1.6.3 Floatables Management

Floatables management will require installation of a screening system to capture floatable materials. The off-line screens would allow the system to maintain the current level of basement flooding protection. The screens would operate with the control gate in the raised position. A side weir upstream of the gate would direct the flow to the screens located in a new screening chamber, with screened flow discharged to the downstream side of the gate to reconnect into the outfall structure, and discharge to the river.

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

Table 1-6. Floatables Management Conceptual Design Criteria

Item	Elevation/Dimension/Rate	Comment
Top of Gate	225.82 m	
Bypass Weir Crest	225.7 m	
Normal Summer River Level	223.73 m	
Maximum Screen Head	1.97 m	
Peak Screening Rate	0.32 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 15-01. The screens will operate with the control gate in its fully raised position. The 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 LS for routing to the NEWPCC for removal. The provision of screening pumps is dependent on final level assessment within the existing infrastructure and the Dumoulin trunk has potential for gravity screening return to occur. This will be confirmed during the future assessment stage.

The dimensions for the screen chamber to accommodate flow from the side by-pass weir, the screen area, and the routing of the discharge piping downstream of the gate are 2.0 m in length and 3.1 m in width. The existing sewer configuration may have to be modified to accommodate the new chamber.

1.6.4 Green Infrastructure

The approach to green infrastructure (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.

Dumoulin has been classified as a high GI potential district. Land use in Dumoulin is mix of residential, commercial, and institutional. The west end of the district is bounded by the Red River. This district would be an ideal location for cisterns/rain barrels, and rain garden bioretention within the residential areas. Commercial areas are suitable to green roofs and parking lot areas are ideal for paved porous pavement. Bioswales may be suitable to the industrial areas.

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 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 LS, which may 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 would be directed from the main outfall 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 would correlate to the number overflows identified for the district. Having the screenings pumped back to the interceptor system via a small LS and force main will be required. The screenings return will require O&M inspection after each event to assess the performance of the return pump system.

1.8 Performance Estimate

An InfoWorks CS hydraulic model was created as part of the CSO Master Plan development. 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	59	59	2,837	74	N/A
2037 Master Plan – Control Option 1	59	59	2,837	74	IS, SC

Notes:

Table 1-7. InfoWorks CS District Model Data

Model Version	Total Area (ha)	Contributing Area (ha)	Population	% Impervious	Control Options Included in Model

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

Control Option	Preliminary Proposal	Master Plan			
	Annual Overflow Volume (m^3)	Annual Overflow Volume (m^3)	Overflow Reduction (m^3)	Number of Overflows	Pass Forward Flow at First Overflow [a]
Baseline (2013)	47,112	49,524	-	14	0.169 m^3/s
In-Line Storage	46,894	42,539	6,985	14	0.162 m^3/s
Control Option 1	**46,894**	**42,539**	**6,985**	**14**	**0.162 m^3/s**

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

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. The improvement of this district is also associated with the proposed control options for the upstream gravity La Verendrye district.

1.9 Cost Estimates

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

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

Control Option	2014 Preliminary Proposal Capital Cost	2019 CSO Master Plan Capital Cost	2019 Annual Operations and Maintenance Cost	2019 Total Operations and Maintenance (Over 35-year period)
In-Line Storage	N/A [a]	$2,250,000 [b]	$41,000	$880,000

Table 1-9. 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)
Screening		$1,920,000 [c]	$45,000	$970,000
Subtotal	**$0**	**$4,170,000**	**$86,000**	**$1,850,000**
Opportunities	N/A	$420000	$9,000	$190,000
District Total	**$0**	**$4,590,000**	**$95,000**	**$2,040,000**

[a] Solution development as refinement to Preliminary Proposal costs submission. Revised costs for this control gate and screenings work found to be $1,810,000 in 2014 dollars.

[b] Costs associated with any revision to existing off-take, as required, to accommodate the control gate location and allow the intercepted CS flow to reach the existing Dumoulin CS LS are 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 calculation of the cost estimate for the CSO Master Plan includes the following:

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

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

Table 1-10. Cost Estimate Tracking Table

Changed Item	Change	Reason	Comments
Control Options	In-Line Storage	Control Gate was not included in the Preliminary Proposal cost estimate	Added for the MP to further reduce overflows and optimize in-line storage

Table 1-10. Cost Estimate Tracking Table

Changed Item	Change	Reason	Comments
	Screening	Screening was not included in the Preliminary Proposal cost estimate.	Added in conjunction with the Control Gate.
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 1-11 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 Dumoulin district would be classified as high potential for implementation of complete sewer separation as a feasible approach to meet future performance targets. The non-separation measures recommended as part of this district engineering plan to meet Control Option 1, specifically in-line storage and floatables management via off-line screening, are therefore at risk of becoming redundant and unnecessary when the measures to achieve future performance targets are pursued. As a result, these measures should not be pursued until the requirements to meet future performance targets are more defined. Should it be confirmed that complete separation is the recommended solution to meet future performance targets, then complete separation will likely be pursued to address Control Option 1 instead of implementing the non-separation measures. This will be with the understanding that while initial complete separation is less cost-effective to meet Control Option 1, it is the most cost effective solution to meet the future performance target and removes the capital costs on short term temporary solutions. The focused use of green infrastructure at key locations would also be utilized to provide volume capture benefits 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	• Sewer Separation • Increased use of GI

The control options selected for the Dumoulin district has been aligned for the 85 percent capture performance target based on the system wide basis. The expandability of this district to meet the 98 percent capture would not align with the proposed options for the 85 percent capture target. The future higher level of percent capture indicate that complete sewer separation would be applicable in this district. This district is linked to the upstream La Verendrye district, as this district discharges via gravity directly to the Dumoulin CS LS and any recommendations require to be integrated with those of La Verendrye district.

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

1.11 Risks and Opportunities

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

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

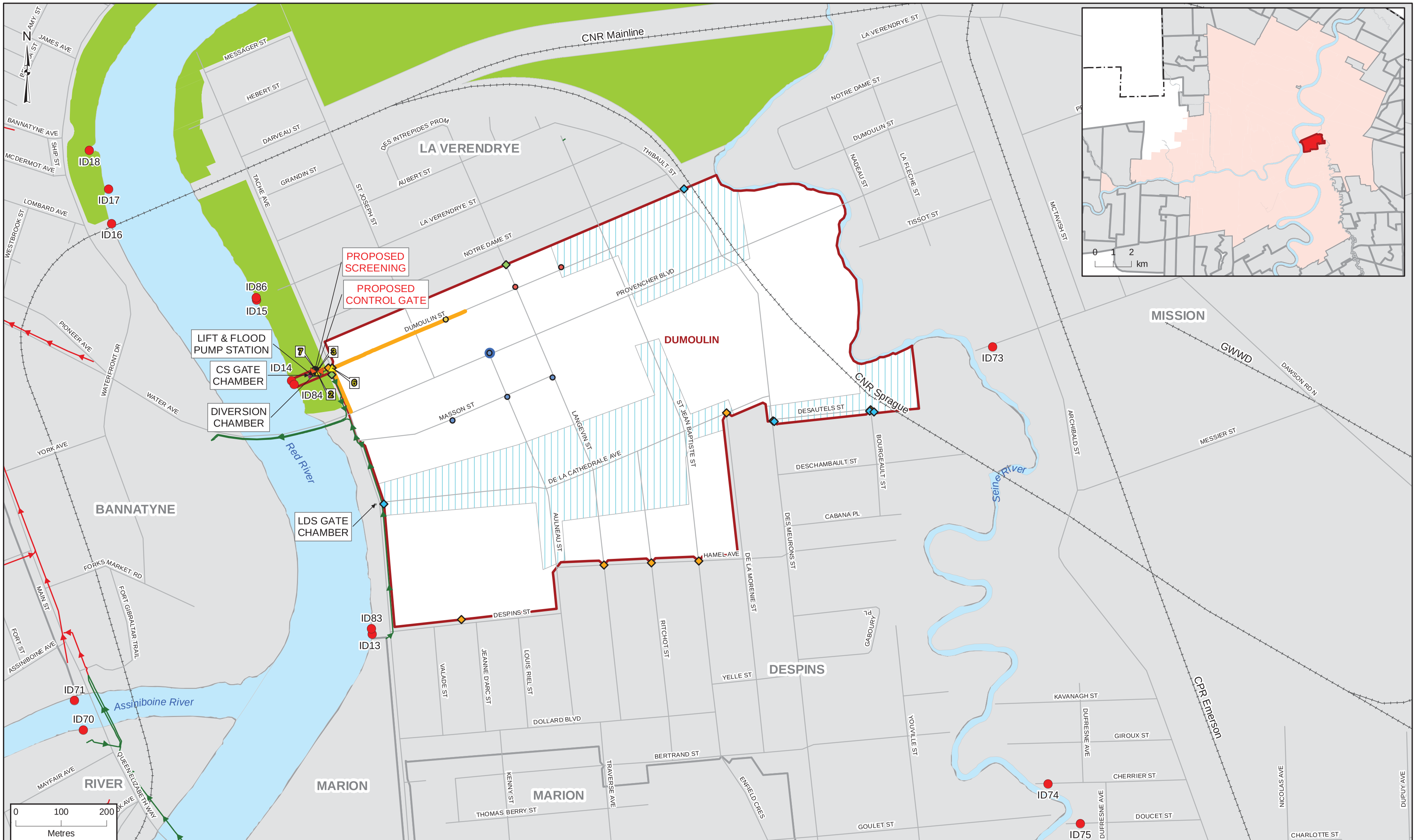
Table 1-12. Control Option 1 Significant Risks and Opportunities

Risk Number	Risk Component	Latent Storage / Flap Gate Control	In-line Storage / Control Gate	Off-line Storage Tank	Off-line Storage Tunnel	Sewer Separation	Green Infrastructure	Real Time Control	Floatable Management
1	Basement Flooding Protection	-	R	-	-	-	-	-	-
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

Wardrop Engineering Consultants (Wardrop). 2006. *Dumoulin and La Verendrye Districts Combined Sewer Relief Study*. Prepared for the City of Winnipeg. December.



LEGEND

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

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

District Boundary Crossing
- 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

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

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

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

FIGURE 15
District Overview Map
Sewer District: Dumoulin
City of Winnipeg
Combined Sewer Overflow Master Plan

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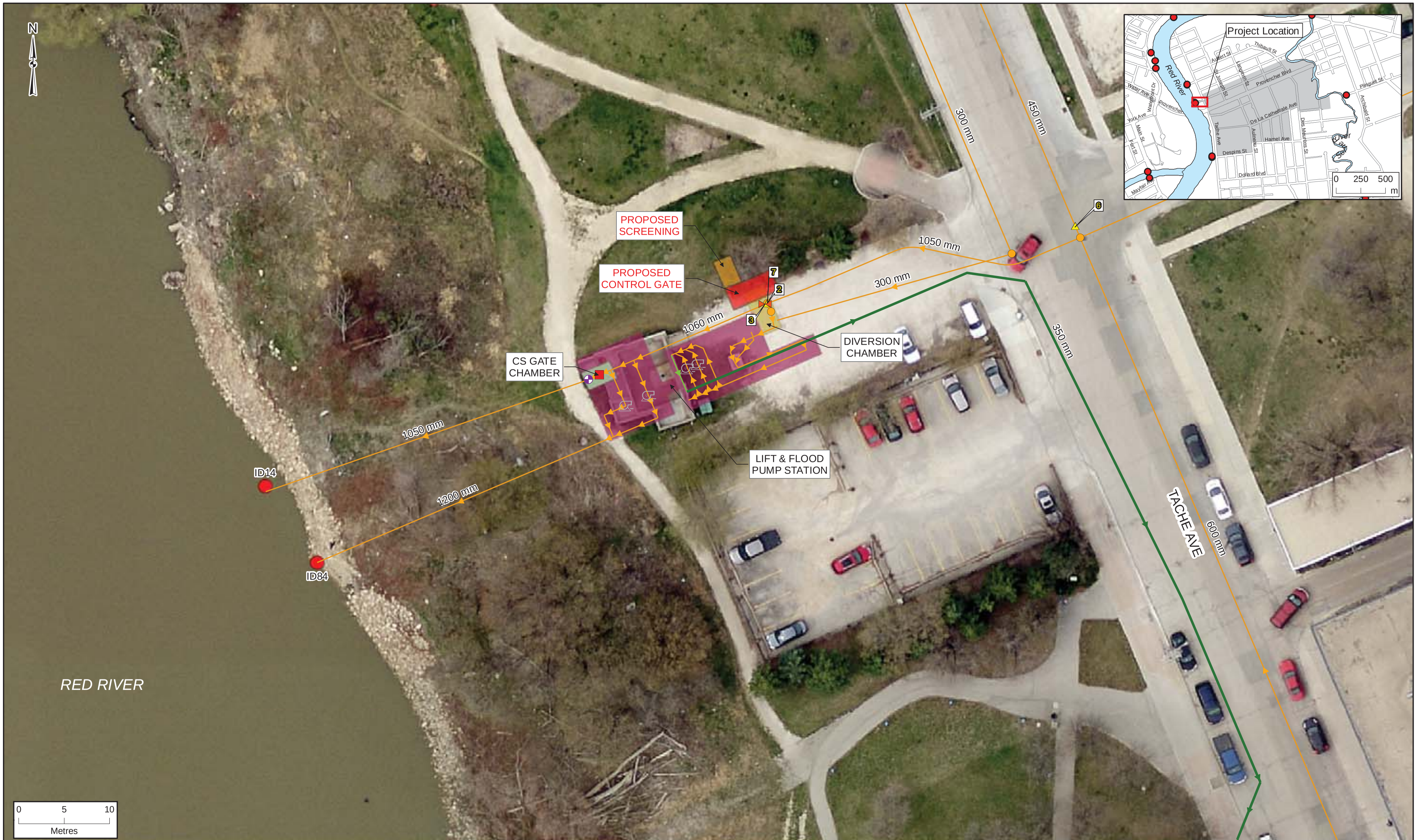

LEGEND

- 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
- Diversion Chamber
- Lift & Flood Combined 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

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

FIGURE 15-01
Control Gate and Screening
Sewer District: Dumoulin
City of Winnipeg
Combined Sewer Overflow Master Plan

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