CSO Master Plan

Riverbend District Plan

August 2019

City of Winnipeg

CSO Master Plan

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2	08/12/2019	Final Draft Submission	DT	MF	MF
3	08/16/2019	Final Submission For CSO Master Plan	MF	MF	SG

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1. Riverbend District

1.1 District Description

The Riverbend district is located towards the western section of the North End Sewage Treatment Plant (NEWPCC) catchment area within the combined sewer (CS) area on the north side of the Assiniboine River. Riverbend is approximately bordered by Saskatchewan Avenue to the north, St. James Street to the east, Marjorie and Century Streets to the west, and the Assiniboine River to the south. The district is also bounded to the north by the Riverbend Separate district.

Riverbend land use includes areas of residential, commercial, and industrial. Commercial land use is located along St. James Street, Century Street, and King Edward Street; industrial manufacturing facilities are located in the north between Ellice Avenue and Saskatchewan Avenue.

Century Street, King Edward Street, and St. James Street are regional roadways that run north-south through the district. Portage Avenue, Silver Avenue, St Matthews Avenue, Ellice Avenue, Sargent Avenue, and Wellington Avenue are regional roadways that run east-west through the district. The area is a major shopping district and is a main link between Downtown and the airport.

1.2 Development

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

1.3 Existing Sewer System

Riverbend encompasses a combined area of 227 hectares (ha)[1] based on the district boundary and includes CS and land drainage sewer (LDS) system. There is approximately 3 percent (8 ha) separated.

Riverbend is planned to have separation work that primary includes the installation of additional LDS and use of the existing CS system for wastewater primarily. As of December 2018, no additional areas of district have been separated, but as part of the work ongoing the district is anticipated to be completely separated in the future.

The CS system includes a CS lift station (LS) and one CS outfall. The CS outfall is located immediately west of Riverbend Crescent. The district is served by a 1500 mm main trunk flowing southbound on King Edward/Century Street; this becomes a 1950 mm CS south of Ellice Avenue, a 2100 mm from St. Matthews to Century Street, and a 2250 mm main trunk that runs south on Century Street. This trunk sewer on Century Street veers southwest at the Century near the Portage Underpass and flows to the Riverbend CS LS located in a back lane west of Riverbend Crescent and South of Portage Avenue. A 450 mm CS serves the small residential area along Riverbend Crescent, south of Portage Avenue and connects into the 2250 mm outfall trunk via a hole and outlet pipe in the base of the manhole in the 450 mm CS. In the past, this 450mm pipe would pass directly over the 2250mm outfall, and continue west to the Parkside district. It was realized this hole in the pipe where the 450mm pipe passes directly over the outfall trunk can be used to more efficiently tie this CS into the Riverbend district directly. A 1 meter brick weir is also installed in this manhole along the 450mm pipe, to ensure the CS collected from the Riverbend Crescent area is captured by the hole in the manhole base.

[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), sewage is intercepted by the primary weir for the district, located immediately upstream of the outfall gate chamber. Sewage from the 450 mm Riverbend Crescent CS is also intercepted by the 1 metre brick weir, and flows the Riverbend outfall to also be intercepted by the primary weir. The intercepted sewage backs up in the 2250 mm trunk sewer from the CS outfall and is diverted through a 600 mm off-take pipe to the Riverbend LS, located near the intersection of Portage Avenue and Riverbend Crescent. From here it is pumped to the 900 mm interceptor pipe on Portage Avenue and on to the NEWPCC for treatment.

During wet weather flow (WWF) the level of flow may exceed the primary weir height, at this point it spills over this weir and is discharged by gravity to the Assiniboine River via the Riverbend outfall. A sluice gate and flap gate are installed at the CS outfall, with the flap gate preventing back-up of the Assiniboine River into the CS system during high river levels. There is no flood station provided to relieve the CS which has spilled over the primary weir under these high river level conditions. Temporary flood pumps are installed in Riverbend based on the flood manual high river level triggers to deal with situations such as this. Under WWF conditions as well, the flow received from the 450mm CS servicing the Riverbend Crescent area may spill over the 1 metre brick weir installed in the manhole directly over the CS outfall. All flow which spills over this brick weir then continues west to the Parkside district.

A 1500 mm LDS runs north to south through the entire length of the district, called the Brookland-Rosser Industrial Trunk LDS. The Brookland-Rosser Industrial Trunk LDS serves two separate sewer districts north of Riverbend, the Riverbend Separate and Brooklands districts. This LDS trunk sewer includes an outfall to the Assiniboine River at Century near the St. James Bridge. This outfall has positive gate protection to protect against high Assiniboine River levels backflowing into the LDS system.

An underpass pumping station for the St. James Underpass is also located in this district. This underpass pumping station discharges to a 900 mm LDS outfall to the Assiniboine River, located beneath the St. James Bridge. This outfall has both flap and positive gates to protect against high Assiniboine River levels backflowing into the LDS system.

The areas already considered LDS separated within the Riverbend district cover the Madison Square shopping mall and the section of Route 90 approximately between Portage Avenue and St James Street.

The CS outfall to the Assiniboine River is as follows:

- ID50 (S-MA20008967) – Riverbend CS Outfall

1.3.1 District-to-District Interconnections

There are several district-to-district interconnections between Riverbend and the surrounding districts. These interconnections are shown on Figure 35 for Riverbend district and show the locations where gravity flow crosses from one district to another. Each interconnection is listed in the following subsections.

1.3.1.1 Interceptor Connections – Downstream of Primary Weir

Tylehurst

- A 900mm interceptor carrying intercepted CS flows by gravity from the Riverbend district into the Tylehurst district and on to the North End Sewage Treatment Plant (NEWPCC) for treatment.
    - Portage Avenue interceptor invert – 230.01 m (S-MH20010370)

1.3.1.2 Interceptor Connections – Upstream of Primary Weir

Ferry Road

- A 900mm interceptor carrying intercepted CS flows by gravity from the Ferry Road district into the Riverbend district and on to the North End Sewage Treatment Plant (NEWPCC) for treatment.

    - Portage Avenue interceptor invert – 230.65 m (S-MH20008213)

Parkside

- A 300 mm interceptor pipe carrying CS intercepted from the Parkside district enters the Riverbend district and ties into the Riverbend CS outfall upstream of the primary weir.
    - Invert at Riverbend district boundary – 226.79 m (S-MH70005194)

1.3.1.3 District Interconnections

Ferry Road

CS to CS

- A 300 mm CS sewer acts as an overflow pipe from the Ferry Road CS system into the Riverbend CS system:
    - St. Matthews Avenue and Marjorie Street – 230.65 m (S-MH20007039) – (GIS suspected to be incorrect and interconnection as high point manhole at 230.85 m (S-MH20007046), further investigation required)
- High Point Manhole (flow is directed into both districts from this manhole):
    - Silver Avenue and Madison Street – 231.52 m (S-MH20009635)

Riverbend Separate

CS to CS

- High Point Manhole (flow is directed into both districts from this manhole):
    - Sherwin Road and Saskatchewan Avenue – 231.48 m (S-MH20006484)
    - Border Street and Saskatchewan Avenue – 230.30 m (S-MH70058515)

WWS to CS

- A 600 mm WWS from Riverbend Separate flows by gravity into the Riverbend CS system in the manhole at the intersection of Saskatchewan Avenue and King Edward Street:
    - King Edward Street – 229.45 m (S-MH20006458)

LDS to LDS

- A 1500 mm LDS flows by gravity southbound on King Edward Street from Riverbend Separate into Riverbend. It flows through Riverbend to discharge into the Assiniboine River:
    - Invert at Riverbend district boundary –224.43 m (S-MH20006451)

A district interconnection schematic is included as Figure 1-1**Error! Not a valid bookmark self-reference.**. The drawing illustrates the collection areas, interconnections, pumping systems, and discharge points for the existing district.

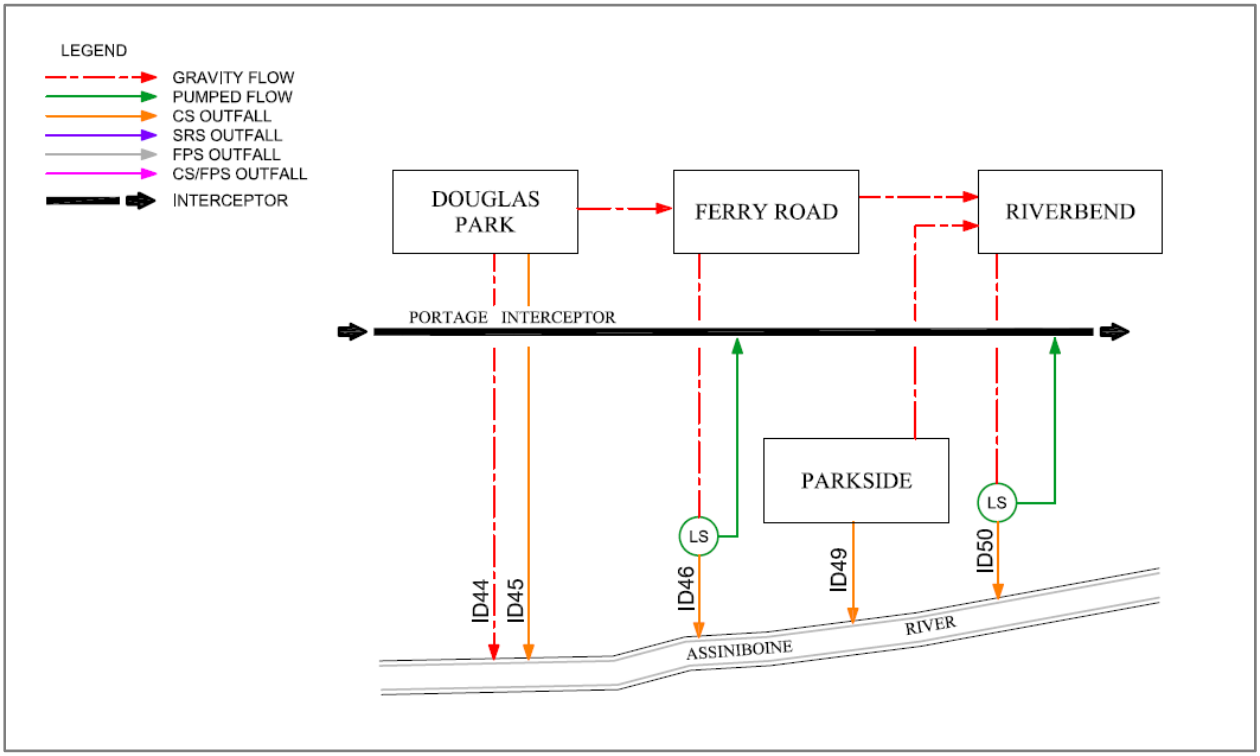

Figure 1-1. District Interconnection Schematic

1.3.2 Asset Information

The main sewer system features for Riverbend are shown on Figure 35 and are listed in Table 1-1.

Table 1-1. Riverbend Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
Combined Sewer Outfall (ID50)	S-CG00001136 DS.1	S-MA20008967	2340 mm	Circular Invert: 224.00 m
Flood Pumping Outfall	N/A	N/A	N/A	No flood pump station within the district.
Other Overflows	N/A	N/A	N/A	
Main Sewer Trunk	S-TE20002146.1	S-MA70040303	2280 mm	Circular Invert: 225.07 m
SRS Outfalls	N/A	N/A	N/A	No SRS within the district.
SRS Interconnections	N/A	N/A	N/A	No SRS within the district.
Main Trunk Flap Gate	S-CG00001136.1	S-CG00001137	1800	Flap Gate size Invert: 225.56 m
Main Trunk Sluice Gate	S-MH20008302.1	S-CG00001136	2250 x 2250 mm	Sluice Gate size Invert: 225.56 m
Off-Take	S-TE20002181.1	S-MA20008912	600 mm	Circular Invert: 225.20 m
Dry Well	N/A	N/A	N/A	
Lift Station Total Capacity	N/A	N/A	0.302 m^3/s	

Table 1-1. Riverbend Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
Lift Station ADWF	N/A	N/A	0.0268 m^3/s	
Lift Station Force Main	S-TE70026794.1	S-MA20008911	300 mm	Circular Invert: 224.00 m
Flood Pump Station Total Capacity	N/A	N/A	N/A	No flood pump station within the district.
Pass Forward Flow – First Overflow	N/A	N/A	0.040 m^3/s	

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	224.26
2	Trunk Invert at Off-Take	225.20
3	Top of Weir	226.09
4	Relief Outfall Invert at Flap Gate	N/A
5	Low Relief Interconnection	N/A
6	Sewer District Interconnection (Tylehurst)	230.01
7	Low Basement	231.74
8	Flood Protection Level	230.41

[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 Riverbend was in 2006 with the *Ferry Road and Riverbend Combined Sewer Relief Works* (Wardrop, 2006). This study discussed the possible relief work available for Ferry Road and Riverbend CS Systems to reduce the incidence of basement flooding. The southern portion of the district has been separated with the installation of a separate LDS sewer.

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 Riverbend 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.

Table 1-3. District Status

District	Most Recent Study	Flow Monitoring	Hydraulic Model	Status	Planned Completion
35 - Riverbend	2006 - Conceptual	Future Work Following Complete Separation	2013	Separation Ongoing	TBD

Note:
TBD = to be determined

1.5 Ongoing Investment Work

The Riverbend basement flooding relief (BFR) work began in 2013 with ongoing separation work being completed within the district. Once complete, it will provide complete road drainage separation of the Riverbend district. Once completed, it will provide complete road drainage separation of the Ferry Road, Douglas Park, Parkside and Riverbend districts. Separation work will be integrated into the CSO Master Plan along with other control options.

There is ongoing maintenance and calibration of permanent instruments installed within the primary outfall within the Riverbend 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 Riverbend district are listed in Table 1-4. The proposed CSO control solution is complete sewer separation. 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 decision to include complete sewer separation of Riverbend under the BFR work will remove a large volume of land drainage from the CS system, thereby reducing the volume and number of CSOs for the district. The intent of complete separation would be to eliminate all CSOs from the district under the 1992 representative year rainfall conditions. This will require post separation monitoring to confirm the elimination of CSOs and remaining wet weather response in the district from existing building foundation drainage connections to the CS system.

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

Sewer separation is proposed for the Riverbend district as part of the CSO Master Plan and is underway as part of the Ferry Road and Riverbend BFR work. Complete separation of Riverbend will remove a large volume of land drainage runoff from the CS system, thereby reducing the volume and number of CSOs for the district.

The work would include the installation of an independent LDS system to collect road drainage. Collected stormwater would be routed down the local streets to new LDS pipes on Portage Avenue and diverted south down Winston Drive to connect to the new separate LDS outfall in Jae Eadie Park (as part of the Parkside district separation project). This Jae Eadie Park outfall will then discharge to the Assiniboine River. The extent of the proposed LDS system upstream of this point is still under development as part of the BFR work, and the location of the LDS system should be assessed further at the preliminary design stage. The flows to be collected after separation will be as follows:

- DWF will remain the same – collected flow pumped from Riverbend CS LS to the interceptor.
- WWF will consist of sanitary sewage combined with foundation drainage.

This will result in a reduction in combined sewage flow received at Riverbend CS LS after the separation project is complete. It is proposed that future monitoring of the district is completed to verify that the sewer separation is fully compliant with the modelled simulated elimination of all CSO overflows under the 1992 representative year. A static weir elevation increase may be necessary at the CS diversion to eliminate the occurrence of all CSOs. Any weir elevation raise will also be evaluated in terms of existing basement flood protection to ensure the existing level of basement flood protection remains.

1.6.3 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.

Riverbend has been classified as a medium GI potential district. Riverbend land use includes areas of residential, commercial, and industrial. Commercial land use is located along St. James Street, Century Street, and King Edward Street; industrial manufacturing facilities are located in the north between Ellice Avenue and Saskatchewan Avenue. This means the district would be an ideal location for bioswales, permeable paved roadways, cisterns/rain barrels, rain gardens, and green roofs.

1.6.4 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 master plan projects with long term consideration for implementation on a system wide basis.

1.7 System Operations and Maintenance

System operations and maintenance (O&M) changes will be required to address the proposed control options. This section identifies general O&M requirements for each control option proposed for the district. More specific details on the assumptions used for quantifying the O&M requirements are described in Part 3C of the CSO Master Plan.

Sewer separation will include the installation of additional sewers that will require inspection, cleaning and rehabilitation. This will result in additional maintenance costs over the long term, but operational costs will be minimal. The existing larger CS pipes within the district may also receive insufficient flow 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.

It is recommended to continue to maintain and operate the flow monitoring instrumentation and assess the results after district separation work has been completed. This will allow the full understanding of the non-separated storm elements (foundation drain connections to the CS system) extent within the Riverbend district.

1.8 Performance Estimate

An InfoWorks CS hydraulic model was created as part of the CSO Master Plan development. An individual model was created to represent the sewer system baseline as represented in the year 2013 and a model for the CSO Master Plan with the control options implemented in the year 2037. A summary of relevant model data is summarized in Table 1-5.

Table 1-5. InfoWorks CS District Model Data

Model Version	Total Area (ha)	Contributing Area (ha)	Population	% Impervious	Control Options Included in Model
2013 Baseline	169	169	1,213	59	N/A
2037 Master Plan – Control Option 1	169	25	1,213	1	SEP

Notes:

Total area is based on the model subcatchment boundaries for the district.
SEP = Separation
% = percent

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. While this district is to be separated and as a result Clause 8 of Licence No. 3042 will not be in effect, the wet weather response of the district overall will still need to be assessed.

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 estimates for Control Option 1 as shown in Table 1-6 are based on the hydraulic model simulation using the 1992 representative year applied uniformly. The control option performance is compared to the baseline performance to determine the overflow reduction. The baseline performance was determined for the existing conditions represented in the hydraulic model based on 2013 system conditions.

Table 1-6. Performance Summary – Control Option 1

Control Option	Preliminary Proposal Annual Overflow Volume (m^3)	Master Plan Annual Overflow Volume (m^3)	Overflow Reduction (m^3)	Number of Overflows	Pass Forward Flow at First Overflow [a]
Baseline (2013)	87,370	87,057	-	20	0.040 m^3/s
Separation	0	0	87,057	0	TBD
Control Option 1	**0**	**0**	**87,057**	**0**	**TBD**

[a] Pass forward flows assessed up to 5-year design rainfall event. Possible overflow for larger design events to be confirmed.

The percent capture performance measure is not included in Table 1-6, as it is applicable to the entre CS system, and not for each district individually. However, the full capture of overflows volumes for the Riverbend district would represent a 100 percent capture rate on a district level.

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 relevant control option with overall program costs summarized and described in Section 3.4 of Part 3A of the CSO Master Plan are identified in Table 1-7. The cost estimates are a Class 5 planning level estimate with a level of accuracy range of minus 50 percent to plus 100 percent.

Table 1-7. 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)
Sewer Separation	$76,800,000	$76,590,000	$45,000	$980,000
In-line Control Gate	$7,700,000 [a]	N/A	N/A	N/A
Screening		N/A	N/A	N/A
Subtotal	**$84,500,000**	**$76,590,000**	**$45,000**	**$980,000**
Opportunities	N/A	$7,660,000	$5,000	$100,000
District Total	**$84,500,000**	**$84,250,000**	**$50,000**	**$1,080,000**

[a] Screening and In-line costs were combined in the Preliminary Proposal.

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 1-8.

Table 1-8. Cost Estimate Tracking Table

Changed Item	Change	Reason	Comments
Control Options	Sewer Separation	Unit Costs were updated	
	Control Gate	Removed from Master Plan	No longer required with complete separation work.
	Screening	Removed from Master Plan	No longer required with complete separation work.
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 complete separation of the Riverbend district will achieve the 100 percent capture figure, and no other further work will be required to meet the future performance target. It is recommended to complete post separation modelling to confirm the target is fully achieved.

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 as part of the CSO Master Plan 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 1-9.

Table 1-9. 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	-	-	-	-	**O**	-	-	-
2	Existing Lift Station	-	-	-	-	-	-	**R**	-
3	Flood Pumping Station	-	-	-	-	**O**	-	-	-
4	Construction Disruption	-	-	-	-	**R**	-	-	-

Table 1-9. 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
5	Implementation Schedule	-	-	-	-	R	-	R	-
6	Sewer Condition	-	-	-	-	-	-	-	-
7	Sewer Conflicts	-	-	-	-	R	-	-	-
8	Program Cost	-	-	-	-	R	-	-	-
9	Approvals and Permits	-	-	-	-	-	R	-	-
10	Land Acquisition	-	-	-	-	-	R	-	-
11	Technology Assumptions	-	-	-	-	O	O	O	-
12	Operations and Maintenance	-	-	-	-	R / O	R	O	-
13	Volume Capture Performance	-	-	-	-	-	O	O	-
14	Treatment	-	-	-	-	O	O	O	-

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

1.12 References

Wardrop. 2006. *Ferry Road and Riverbend Combined Sewer Relief Works*. Prepared for the City of Winnipeg Water and Waste Department. November.

N

RIVERBEND S

SASKATCHEWAN AVE

SHERWIN RD

BORDER ST

MCCROSSEN ST

MIDLAND ST

AUBREY

RICHARD AVE

ADMINISTRATION ST

JAMES ARMSTRONG RICHARDSON INTERNATIONAL AIRPORT

BRADFORD ST

FLIGHT RD

RIVERBEND

SANFORD ST

Midland

SARGENT AVE

CLIFTON

CPR Spur SJ Industry

WALL ST

GARFIELD ST N

AUBREY

YUKON AVE

MILT STEGALL DR

EMPRESS ST

SPRUCE ST

ERIN ST

CLIFTON ST

INGERSOLL ST

BANNING ST

SIMCOE ST

BEVERLEY ST

TORONTO ST

VICTOR ST

AGNES ST

MCGEE ST

ST JAMES ST

ELLICE AVE

TYLEHURST

VALOUR RD

ASHBURN ST

STRATHCONA ST

TELFER ST N

DOMINION ST

SHERBURN ST

LIPTON ST

BURNELL ST

ARLINGTON ST

HOME ST

ST MATTHEWS AVE

COLONY

HANGAR LINE RD

ALLEY AI ST

LONDON RD

CANBERRA AVE

INTERSITE RD

BERRY ST

MADISON ST

CPR Lariviere

GOULDING ST

MINTO ST

HUNTLEIGH ST

MARYLAND ST

AIR FORCE WAY

Truro Creek

SILVER AVE

MAROONS RD

Omand's Creek

CORNISH

PICARDY PL

BROADWAY

HONEYMAN AVE

PRESTON AVE

LYLE ST

TRURO ST

MARJORIE ST

HAMPTON ST

BROOKLYN ST

KING EDWARD ST

QUEEN ST

KENSINGTON ST

DENSON PL

RIDDLE AVE

PURCELL AVE

DUNDURN PL

NESS AVE

INGLEWOOD ST

FERRY RD

ROSEBERRY ST

COLLEGIATE ST

PARKVIEW ST

AMHERST ST

RUTLAND ST

EASTWAY

GREENWOOD PL

CAMDEN PL

NEWMAN ST

BASSWOOD PL

SPRAGUE ST

GARFIELD ST S

WESTMINSTER AVE

RUBY ST

LENORE ST

EVANSON ST

ETHELBERT ST

CANORA ST

CHESTNUT ST

WALNUT ST

TURNER AVE

VAVASOUR AVE

MOORGATE

MOORGATE ST

BRUCE AVE

GUILDFORD ST

WOODLAWN ST

BELVIDERE ST

MANDEVILLE ST

OVERDALE ST

WINCHESTER ST

LINWOOD ST

SACKVILLE ST

ALBANY ST

FERRY ROAD

LIFT STATION

PORTAGE AVE

CENTURY ST

KINTYRE ST

RICHMOND ST

TYLEHURST ST

EMPRESS ST E

AUBREY ST

WOLSELEY AVE

PALMERSTON AVE

MOUNT ROYAL RD

FIDLER AVE

HARMON AVE

CONWAY ST

SHARP BLVD

DUFFIELD ST

LODGE AVE

HIND AVE

CS GATE CHAMBER

RIVERBEND CRES

RIVEROAKS DR

DOUGLAS PARK

PARKSIDE

ID50

ID51

ID52

ID53

UNDERPASS STATION

LDS GATE CHAMBER

WELLINGTON CRES

ASH

BROCK ST

NIAGARA ST

WATERLOO ST

ASH ST

OAK ST

ID72

ID81

ID54

ID89

ID55

ID56

ID57

ID80

ID58

ID59

ID60

ID61

ID82

Assiniboine River

JESSIE

ACADEMY RD

0 100 200
Metres

0 1 2
km

LEGEND

- Primary Weir
- Critical Elevation
- CSO Outfall
- Low CS Manhole
- Inter-System Connection: CS - WWS
- District Boundary Crossing: CS, LDS, WWS
- Force Main
- Street
- Railway
- District Boundary
- Watercourse
- Greenspace

CSO MASTER PLAN PROPOSED SOLUTIONS

- Sewer Separation - Underway
- Sewer Separation - Complete

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

JACOBS

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

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

FIGURE 35
District Overview Map
Sewer District: Riverbend
City of Winnipeg
Combined Sewer Overflow Master Plan

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