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CSO Master Plan

Jessie District Plan

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1. Jessie District

1.1 District Description

Jessie district is located in the southwest of the combined sewer (CS) area, south of the Assiniboine River and west of the Red River. Jessie is bounded by the River district to the northeast, Cockburn and Baltimore districts to the south, and Ash district to the west. Figure 34 provides an overview of the sewer district and the location of the proposed Combined Sewer Overflow (CSO) Master Plan control options.

Regional roadways in Jessie include Pembina Highway, Grant Avenue, Corydon Avenue, and Taylor Avenue. The Southwest Transitway is located near the eastern boundary and parallel to Pembina Highway.

The district contains mostly residential land use with commercial land parcels around major transportation routes of Corydon Avenue and Pembina Highway. A small area of industrial land is located near the Red River. Development in the district is mainly the conversion of single family homes to multi-family and the addition of new developments around the Southwest Transit Corridor. Non-residential use in the area is the Winnipeg Transit Fort Rouge Garage, the Deaf Centre Manitoba institute on Pembina Highway, and Earl Grey Community Centre.

1.2 Development

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

1.3 Existing Sewer System

The Jessie district has an approximate area of 397 ha[1] and is serviced within Jessie district with a mix of storm relief sewer (SRS) and combined sewer (CS) pipe. There is no existing separation and none of the district is separation ready. Most of the combined system was constructed between 1900 and 1960. The SRS system was added in the 1970s to provide additional capacity and relieve the CS system.

The CS system includes a lift station (LS), flood pump station (FPS) and one combined CS/FPS outfall. The CS system drains towards the Jessie outfall, located at the east end of Jessie Avenue at the Assiniboine River. The main collector sewer is egg-shaped and is aligned down Jessie Avenue. This sewer varies in size from 1350 by 1800 mm to 1800 by 2400 mm. At the outfall, flow is diverted to the Jessie CS lift station (LS) where it is pumped through River district, across the Assiniboine River and to the Main Interceptor. Otherwise, flow may overflow the diversion weir to the outfall and flow by gravity to the Assiniboine River.

The SRS system extends throughout the district and has multiple interconnections with the CS system. The SRS system provides relief and extra capacity during high flow event and allows the CS to overflow into the SRS. When CS capacity is regained, the SRS drains back into the CS system. Most catch basins are still connected to the CS system, so partial separation has not been completed throughout most of the district. The northwest portion of Jessie includes a SRS system with an independent outfall. A 1350 mm SRS is installed along Grosvenor Avenue and flows to the Assiniboine River off Wellington Crescent. A flap gate and sluice gate are installed on the outfall pipe to control backflow into the SRS system under high river level conditions in the Red River.

During dry weather flow (DWF), the existing weir diverts flow to the Jessie CS LS through two 600 mm off-take pipes and is pumped through two 300 mm force mains to the River district, then travel via a 600

[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.

mm interceptor pipe to the River CS LS and river crossing to the Assiniboine district and on to the North End Sewage Treatment Plant (NEWPCC). During wet weather flow (WWF), any flows that exceeds the diversion capacity of the primary weir is discharged to the river. 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 high river level conditions when gravity flow is not available, Jessie FPS pumps flow to the river through the outfall pipe.

The combined CS and FPS outfall to the Red River is as follows:

- ID10 (S-MA70016174) – Jessie CS/FPS Outfall

1.3.1 District-to-District Interconnections

There are several district-to-district interconnections between Jessie, Ash, Cockburn, Baltimore, and River districts. Each interconnection is shown on Figure 34, and this figure shows gravity and pumped flow from one district to another. The interconnections are as follows:

1.3.1.1 Interceptor Connections – Downstream Of Primary Weir

River

- The Jessie CS LS discharges into a force main that separates into two 250 mm pipes that flow north into River district:
  - Dual 250 mm force mains

1.3.1.2 District Interconnections

Ash

<u>CS to CS</u>

- High Point Manhole (Flow is directed into both districts from this manhole)
  - Corydon Avenue and Cambridge Street – 229.50 m (S-MH60009462)

Cockburn

<u>CS to CS</u>

- High Point Manhole (flow is directed into both districts from this manhole)
  - Ebby Avenue and Wentworth Street – 228.93 m (S-MH60010140)
- A 300 mm CS sewer acts as an overflow pipe from the Cockburn CS system into the Jessie CS system.
  - Jackson Avenue and Stafford Avenue – 229.29 m (S-MH60010066)

Baltimore

<u>LDS to LDS</u>

- A 1350 mm LDS trunk conveys flow from the Fort Rouge Yards development area in Cockburn to an LDS outfall discharging to the Red River by gravity flow in the Jessie sewer district.

River

<u>SRS to CS</u>

- A 450mm SRS discharges into Jessie district CS system at the intersection of Jessie Avenue, between Pembina Highway and Osborne Street:
  - Southern River District SRS Tie-In – 224.35 m (S-MH60009040)
- A 350mm SRS in the River district discharges into Jessie CS system by gravity flow at the intersection of Corydon Avenue and Daly Street:
  - Corydon Avenue SRS Tie-In – 228.353 m
- A 250mm SRS in the River district discharges into Jessie CS system by gravity flow at the intersection of McMillan Avenue and Daly Street:
  - McMillan Avenue SRS Tie-In – 228.32 m (S-MH70016737)
- High Sewer Overflow 250mm SRS overflow pipe connects River's CS to Jessie's CS system).
  - Wellington Crescent & Gertrude - 229.06 m (S-MH60017449)

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 system.

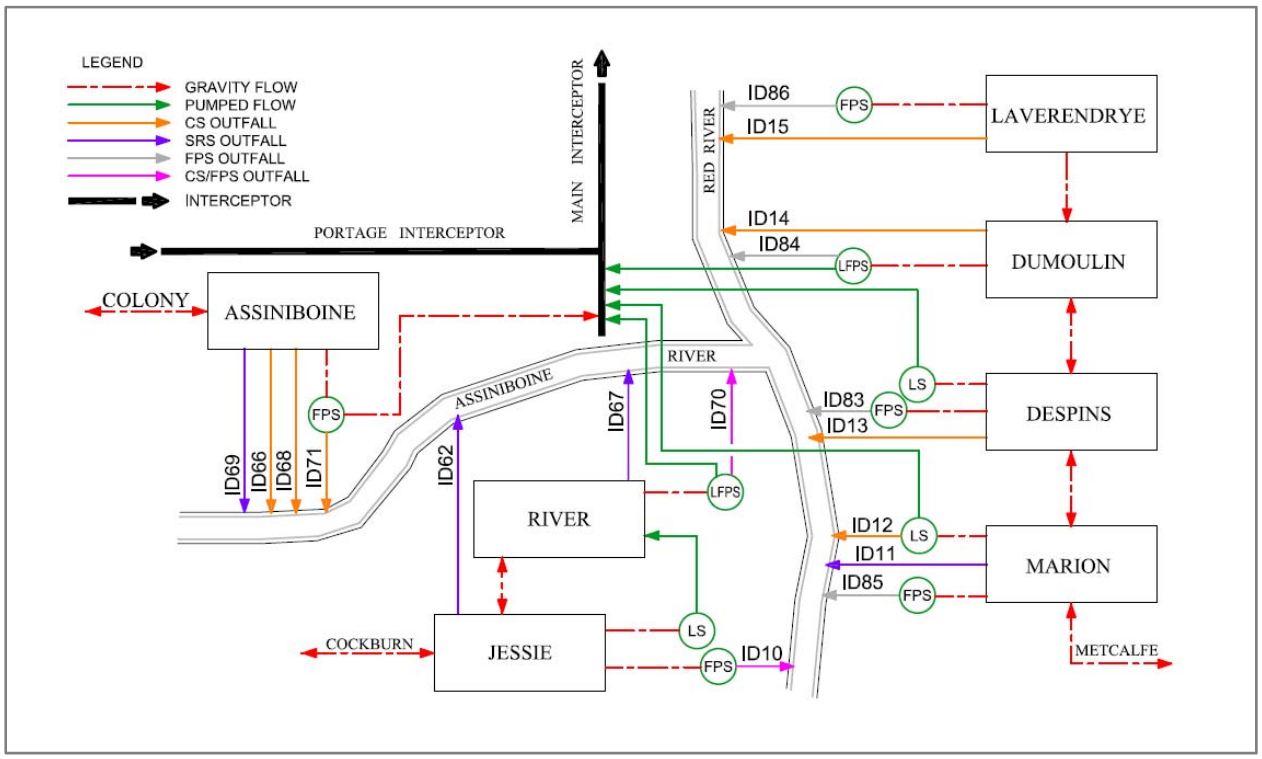


Figure 1-1. District Interconnection Schematic

1.3.2 Asset Information

The main sewer system features for the district are shown on Figure 21 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	S-CO70007409.1	S-MA70016174	2130 mm	Circular Invert: 221.91
Flood Pumping Outfall	S-CO70007409.1	S-MA70016174	2130 mm	Circular Invert: 221.91

Table 1-1. Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
Other Overflows	N/A	N/A	N/A	N/A
Main Trunk	S-TE70007799.1	S-MA70016174	1800 x 2400 mm	Egg-shaped Invert: 222.65m
SRS Outfalls (ID62)	S-CO70003029.1	S-MA70002491	1400 mm	Circular Invert: 224.81
SRS Interconnections	N/A	N/A	N/A	25 SRS - CS (also 4 district interconnections)
Main Trunk Flap Gate	S-CG00000817.1	S-CG00000817	1800 x 2100 mm	Square shaped Invert: 222.78
Main Trunk Sluice Gate	S-CG00000816.1	S-CG00000816	1800 x 2100 mm	Square shaped Invert: 222.78
Off-Take	S-TE70007800.2 S-TE70007799.2	S-MA70003857	600 mm	Invert: 222.78 Invert: 222.87
Dry Well	N/A	N/A	N/A	
Lift Station Total Capacity	N/A	N/A	0.27 m^3/s	2 pumps at 0.135 m3/s
Lift Station ADWF	N/A	N/A	0.088 m^3/s	
Lift Station Force Main	S-YY70021068.2 S-BE70025982.1	S-MA70003857	250 mm	2 x 250 mm Invert: 230.58
Flood Pump Station Total Capacity	N/A	N/A	3.12 m^3/s	2 pumps at 1.156 m^3/s, 1 x 0.808 m^3/s
Pass Forward Flow – First Overflow	N/A	N/A	0.261 m^3/s	

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

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

Table 1-2. Critical Elevations

Reference Point	Item	Elevation (m)[a]
1	Normal Summer River Level	Jessie – 223.73 Grosvenor – 223.84
2	Trunk Invert at Off-Take Pipes	222.78 – West Offtake 222.87 – East Offtake
3	Top of Weir	223.11
4	Relief Outfall Invert at Flap Gate	Grosvenor – 224.83
5	Low Relief Interconnection	226.03[1]
6	Sewer District Low Interconnection (River Combined Sewer District)	224.35
7	Low Basement	230.89

8	Flood Protection Level	230.14

[a] City of Winnipeg Data, 2013

[1]This relief interconnection height is based on an assumed weir structure at this location, with a weir height equal to half of the connecting pipe diameter. This assumption was applied to all locations where SRS overflow pipes are indicated, but based on GIS records an overflow height is not provided.

1.4 Previous Investment Work

The most recent study of Jessie district was completed in 1974 (MacLaren, 1974). This study led to the design and construction of the SRS system to add discharge capacity and increase the level of service for basement flood protection. South East (SE) Jessie was included with the Cockburn sewer relief project, Cockburn Preliminary Design Report (KGS, 2010), and is planned for complete separation. Table 1-3 provides a summary of the district status in terms of data capture and study.

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 Jessie Combined Sewer District was included as part of this program. Instruments installed at each of the thirty nine 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 ID	District	Most Recent Study	Flow Monitoring	Hydraulic Model	Status	Expected Completion
21	Jessie	1974 - Conceptual	Future Work	2013	Study Complete	N/A
21	SE Jessie	2010 - PDR	Future Work	2013	Under Construction (SE Jessie Only)	TBD

Note:
TBD = To Be Determined

1.5 Ongoing Investment Work

As part of the Cockburn BFR program, an LDS system within southeast Jessie will be completed and provide complete road drainage separation.

There is ongoing maintenance and calibration of permanent instruments installed within the primary outfall within the Jessie 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 proposed projects selected to meet Control Option 1 – 85 Percent Capture in a Representative Year for the Jessie sewer district are listed in Table 1-4. The proposed CSO control projects will include partial sewer separation and an alternative floatable management approach. Program opportunities including green infrastructure (GI) and real time control (RTC) will also be included as applicable.

Table 1-4. District Control Option

Control Limit	Latent Storage	Flap Gate Control	Gravity Flow Control	Control Gate	In-Line Storage	Off-line Storage Tank	Off-line Storage Tunnel	Sewer Separation	Green Infrastructure	Real Time Control	Floatable Management
85% Capture in a Representative Year	-	-	-	-	-	-	-	✓	✓	✓	✓

Notes:
- = not included
✓ = included

The existing CS system is not fully suitable for use as in-line storage as the relative low level of the CS LS and associated CS outfall results in the NSWL level being at a similar level to the recommended control gate level (within 100mm) during the 1992 representative year assessment. An area within SE Jessie is undergoing separation in conjunction with the Cockburn district sewer relief project, and will provide the required benefits to the overall CSO Master Plan to meet Control Option 1.

Floatable control will be necessary to capture any undesirable floatables in the sewage overflows. Floatables are typically captured via a screening facility, however, the hydraulic constraints within the Jessie district do not allow sufficient positive head to be achieved and an alternative floatables management approach will be necessary.

The SRS system does not fully allow a cost effective installation of the latent storage option due to minor overflow volume reduction during the 1992 representative year and has not been proposed in this district.

GI and RTC will be applied within each district on a system wide basis with consideration of the entire CS area. The level of implementation for each district will be determined through evaluations completed through district level preliminary design.

1.6.2 Sewer Separation

The SE portion of the Jessie district is programmed to be separated as part of the Cockburn BFR project, this will provide some benefits to the CSO program when complete.

The flows to be collected from the Jessie separation will be as follows:

- Dry weather flows will remain the same for the Jessie district.
- Jessie wet weather flow (WWF) from this separation area will consist of sanitary sewage combined with foundation drainage.
- The majority of Jessie will remain as combined sewage.

This will result in a reduction in the combined sewage flow received at the Jessie CS LS and FPS after the separation project is complete.

1.6.3 Floatables Management

Floatables management for the Jessie district, due to the existing hydraulic constraints, is proposed to be an alternative floatables management approach. This approach is to ensure that the proposed required floatable management requirements outlined within the Environment Act Licence 3042 can be maintained.

This alternative approach to floatables management will be achieved by targeting floatables source control. This will be achieved by implementing more focused efforts towards street cleaning and catch-basin cleaning, to remove floatable material from surface runoff before it enters the combined sewer system. The second broad component of this alternative approach will focus on public education in an effort to reduce the sanitary components from ever entering plumbing systems. This is expected to achieve similar or better results while eliminating the end-of-pipe screening. The proposed approach will be similar to the program currently carried out in the City of Ottawa to meet their CSO mitigation requirements.

The alternative approach will be further investigated and demonstrated during the interim period between the submission of the CSO Master Plan (August 2019) and the revised CSO Master Plan submission (April 2030), and is discussed in further detail in Part 2 of the CSO Master Plan. It is recommended that as part of this work these measures will be undertaken in the Jessie district, due to screening limitations mentioned above.

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 applicable GI controls.

Jessie has been classified as a medium GI potential district. Land use in Jessie is mostly single-family residential. Corydon Avenue includes a mix a commercial businesses. This means the district would be an ideal location for bioswales, permeable paved roadways, cistern/rain barrels, and rain gardens. The flat roof commercial buildings along Corydon Avenue make would be 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 considerations for implementation on a system wide basis.

1.7 System Operations and Maintenance

Systems 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. The alternative floatable management control is based on implementing additional operating and maintenance measures, in an effort to match the performance of the capital construction projects to meet the floatables management requirements. As such dedicated additional operating and maintenance costs should be allocated to this district. The goal however is for this work to overall be more cost effective from a life cycle perspective, considering the upfront capital and operating and maintenance costs associated with screening facilities.

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 1-5.

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	389	382	14,129	36	N/A
2037 Master Plan – Control Option 1	389	374	14,129	32	SEP

Notes:

SEP - Separation

No change to the future population was completed as from a wastewater generation perspective from the update to the 2012 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 statics. 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 1-6 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 when simulations were completed; these are listed to provide an indication of benefit gained only and are independent volume reductions unless noted otherwise.

Table 1-6. 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	189,233	187,594	-	21	0.261 m^3/s
In-Line Storage	189,233	N/A	N/A	N/A	N/A
Latent Storage	189,008	N/A	N/A	N/A	N/A
Separation	161,801	164,392	23,202	21	0.266 m^3/s
Control Option 1	**189,008** [b]	**164,392**	**23,202**	**21**	**0.266 m^3/s**

Note:
[a] Pass forward flows assessed on the 1-year design rainfall event
[b] Incorrect volume taken forward for Preliminary Proposal assessment due to interim solution results. Small reduction due to latent storage component of PP assessment.

The predicted small overflow volume reduction of approximately 400 m^3 for the MP proposed latent storage option at the Grosvenor SRS system was not taken forward due to the relatively high cost component.

Percent capture is not included in the table above, as it is reported for the entire CS collection system and not for each district individually.

1.9 Cost Estimates

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 1-7. The cost estimates are a Class 5 planning level estimates with a level of accuracy of minus 50 percent to plus 100 percent.

Table 1-7. 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 Cost (Over 35-year period)
Separation	$ - [a]	$25,900,000	$15,000	$330,000
Latent Storage	$2,020,000	N/A [b]	N/A	N/A
In-Line Storage (incl. screening)	$ - [a]	N/A [b]	N/A	N/A
Floatables Management Allowance	N/A	$2,540,000 [c]	$45,000 [c]	$960,000
Subtotal	**$2,020,000**	**$28,440,000**	**$60,000**	**$1,290,000**
Opportunities	N/A	$2,840,000	$6,000	$130,000
District Total	**$2,020,000**	**$31,280,000**	**$66,000**	**$1,420,000**

Notes:

[a] Solution developed as refinement to Preliminary Proposal work following submission of Preliminary Proposal costs. Costs for the Separation item of work found to be $16,120,000 and for In-Line Storage (including screening) item of work to be $5,840,000, both in 2014 dollars

b

[b] Latent storage and In-line storage (incl. screening) not taken forward in Master Plan costing

[c] Cost allowance to account for the alternative floatable management measures. This allowance is based on a typical district control gate cost.

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

- Capital costs and O&M costs are reported in terms of present value.
- A fixed allowance of 10 percent has been included for GI, with no additional cost for RTC. This has been listed as part of the Opportunities costs.
- The Preliminary Proposal capital cost is in 2014-dollar values.
- The CSO Master Plan capital cost is based on the control options presented in this plan and in 2019-dollar values.
- The 2019 Total Annual Operations and Maintenance (over 35-year period) cost component is the present value costs of each annual O&M cost under the assumption that each control option was initiated in 2019. Each of these values include equipment replacement and O&M costs.
- 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**Error! Reference source not found.**.

Table 1-8. Cost Estimate Tracking Table

Changed Item	Change	Reason	Comments
Control Options	Floatables Management	Control Gate and screening were not included in the Preliminary Proposal estimate. Screening later determined to not be feasible due to hydraulic constraints. Added to Master Plan cost, assumed to be comparable to typical control gate projected cost.	
	Removal of Latent Storage	The Master Plan assessment found that latent storage not a preferred control solution.	
	Removal of In-Line Storage	The Master Plan assessment found that in-line storage not a preferred control solution.	
	Sewer Separation	Revised unit costs for separation work.	Refer to Cockburn PP costs for the Jessie separation costs
Opportunities	A fixed allowance of 10 percent has been included for program opportunities such as Green Infrastructure	Preliminary Proposal estimate did not include a cost for 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 1-9 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 Jessie district would be classified as a low potential for implementation of complete sewer separation as the only feasible approach to achieve the 98 percent capture in the representative year future performance target. Opportunistic separation of portions of the district may be achieved with synergies with other major infrastructure work to address future performance targets. In addition, green infrastructure and off-line storage tank or tunnel storage may be utilized in key locations to provide additional storage and increase capture volume.

Table 1-9. Upgrade to 98 Percent Capture in a Representative Year Summary

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

The control options for Jessie district have been aligned to meet the 85 percent capture performance target based on the system wide basis. The expandability of this district to meet 98 percent capture target would be based on the system wide basis analysis and the results of the alternative floatables management approach.

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

1.11 Risks and Opportunities

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

The CSO Master Plan has considered risks and opportunities on a program and project delivery level, as described in Section 5 of Part 2 of the CSO Master Plan. A Risk And Opportunity Control Option Matrix covering the district control options has been developed and is included as part of Appendix D in Part 3B. The identification of the most significant risks and opportunities relevant to this district are provided in Table 1-10.

Table 1-10. 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**	-	-	-
5	Implementation Schedule	-	-	-	-	**R**	-	-	-
6	Sewer Condition	-	-	-	-	-	-	-	-
7	Sewer Conflicts	-	-	-	-	**R**	-	-	-
8	Program Cost	-	-	-	-	**R**	-	-	**O**
9	Approvals and Permits	-	-	-	-	-	**R**	-	-
10	Land Acquisition	-	-	-	-	-	**R**	-	-

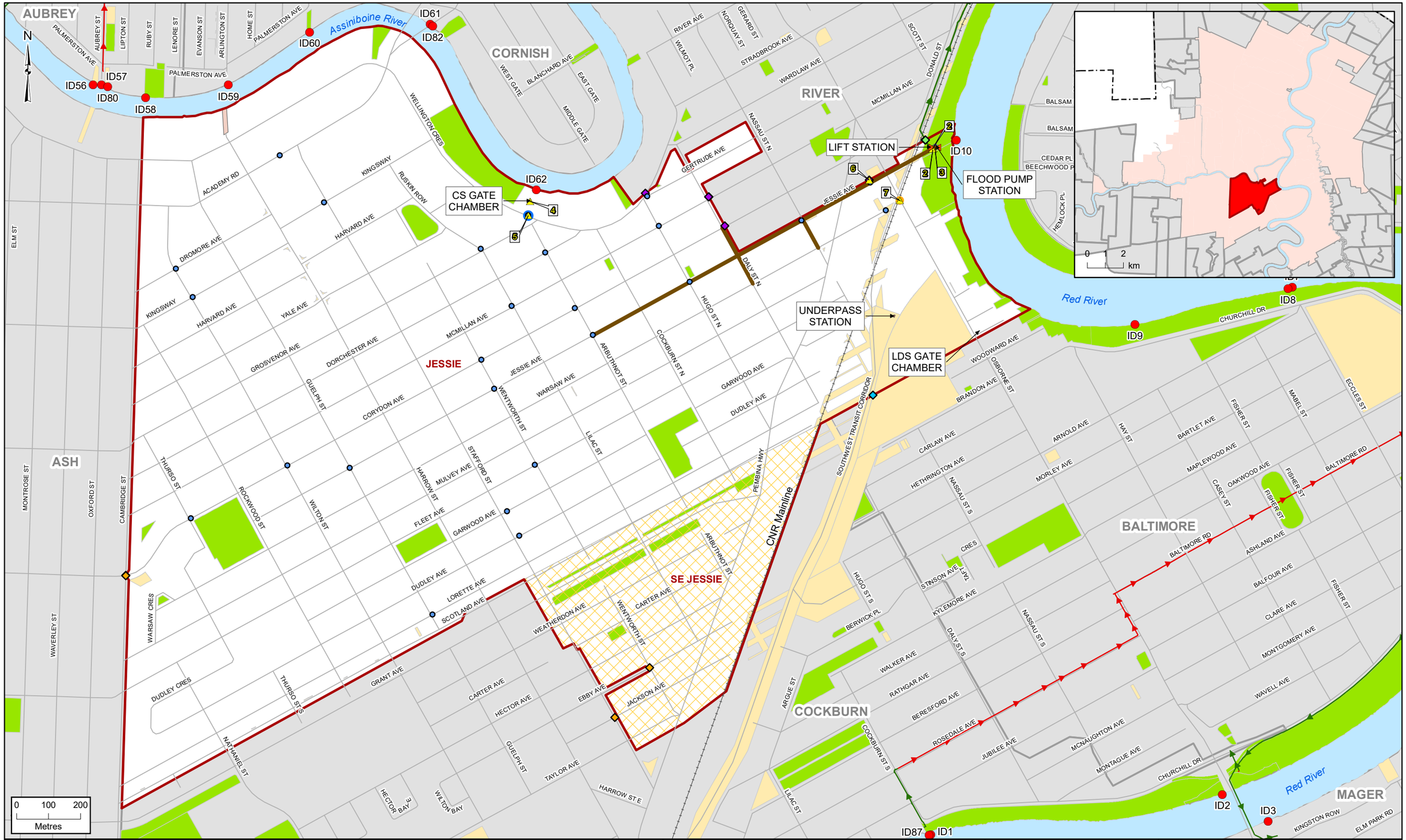
Table 1-10. Control Option 1 Significant Risks and Opportunities

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

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

1.12 References

KGS Group. 2015. *Cockburn and Calrossie Combined Sewer Relief Works Preliminary Design Report.* Prepared for the City of Winnipeg, Waterworks, Waster and Disposal Department. June.



LEGEND

- Primary Weir
- Critical Elevation
- CSO Outfall
- Low CS Manhole
- Low SRS Connection
- Inter-System Connection: SRS - CS
- District Boundary Crossing: CS, LDS, SRS, WWS
- Extent of Existing In-line Storage
- Interceptor Sewer
- Force Main
- Street
- Railway
- District Boundary
- Watercourse
- Greenspace
- City Owned Land

CSO MASTER PLAN PROPOSED SOLUTIONS

Sewer Separation - Underway

Note: Alternative Floatables Management Approach to be tested prior to implementation.

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 34
District Overview Map
Sewer District: Jessie
City of Winnipeg
Combined Sewer Overflow Master Plan

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