

## **APPENDIX C – 2018 OUTFALL RENEWAL AND REHABILITATION CONDITION ASSESSMENT – ARCHIBALD STREET OUTFALL**



**CITY OF WINNIPEG**

**2018 OUTFALL RENEWAL AND REHABILITATION  
CONDITION ASSESSMENT  
ARCHIBALD STREET OUTFALL**

**FINAL**

KGS Group 17-0107-020  
February 2019

PREPARED BY:

Nicole Vidal, C.E.T.  
Municipal Technologist

APPROVED BY:

Ray Offman, P.Eng.  
Infrastructure Engineer/Project Manager

## TABLE OF CONTENTS

1.0	INTRODUCTION / BACKGROUND.....	1
2.0	INSPECTION RESULTS .....	2
2.1	ARCHIBALD STREET OUTFALL INSPECTION RESULTS.....	2
2.1.1	Archibald CCTV Inspection .....	2
2.1.2	Archibald Physical Inspection .....	3
3.0	CONDITION RATING.....	5
3.1	ARCHIBALD STREET OUTFALL (DOWNSTREAM OF THE FLOOD PUMP STATION).....	5
4.0	REHABILITATION OPTIONS .....	6
4.1	ARCHIBALD STREET OUTFALL REHABILITATION OPTIONS.....	6
5.0	COST ESTIMATES .....	7
5.1	ARCHIBALD STREET OUTFALL .....	7
6.0	STATEMENT OF LIMITATIONS AND CONDITIONS .....	8
6.1	THIRD PARTY USE OF REPORT .....	8
6.2	CAPITAL COST ESTIMATE STATEMENT OF LIMITATIONS .....	8

TABLES  
FIGURES  
APPENDICES

## 1.0 INTRODUCTION / BACKGROUND

The Archibald Outfall requires rehabilitation to address structural defects in the concrete portion of the outfall. This report provides a condition assessment of the outfall to assist in the development of the capital budget and to provide information to be considered as part of the preliminary and detailed design.

The Archibald Outfall originates at the flap gate located within the Archibald flood pumping station near the intersection of Archibald Street and Mission Street. The upstream 79 m of the outfall is recorded as being 2600x2080 mm egg shaped brick lined cast-in-place concrete pipe (with brick lining to the pipe haunches), however the actual cross section varies as described herein. A manhole exists at 65 m downstream from the flap gate that provides a secondary access to the concrete portion of the manhole. Downstream of the manhole (~ 13 m), the pipe transitions to a 2600 mm corrugated metal pipe that extends approximately 37 m to the Seine River.

A previous inspection of this outfall was completed by KGS Group in 2011 as part of the Mission Trunk Sewer and outfall condition assessment. Content from that inspection is referenced herein. However, the previous KGS inspection, as well as the recent inspection by AECOM as part of the 2017 outfall condition assessment program did not include observations of the pipe invert, as it was obstructed by Ice from the unregulated winter river level (UWRL). The current assessment included de-icing and cleaning of the outfall to identify the extent of distressed concrete below the UWRL. The assessment also includes internal measurements to assist in the consideration of rehabilitation options for the Archibald Outfall.

## 2.0 INSPECTION RESULTS

### 2.1 ARCHIBALD STREET OUTFALL INSPECTION RESULTS

The 2017/2018 inspection of the Archibald Street Outfall included a Close Circuit Television Inspection (CCTV) and a physical person-entry inspection. Information gathered from this inspection is to supplement the Condition Assessment of the Mission Trunk Sewer and Outfall completed by KGS Group in 2011.

#### 2.1.1 Archibald CCTV Inspection

On February 14, 2018, a CCTV inspection was carried out by Unijet Industrial Pipe Ltd. (Unijet) to assist in the assessment of the Archibald Street outfall and to provide a record of the observed pipe defects and pipe invert below the UWRL.

At the time of inspection, the river level had dropped below the invert elevation at the outlet. However, ice and debris existed along the invert throughout the outfall, from the outlet to the chamber manhole at the flood pump station. Significant de-icing and cleaning was required to expose the pipe invert.

Two inspections were carried out within the outfall. The first inspection was a reverse inspection from the intermediate manhole to the gate chamber at the flood pump station. The second inspection was completed from the intermediate manhole to the outlet at the Seine River.

The following information was obtained from the inspections:

#### Reverse Inspection of Concrete Portion of Outfall

- The concrete portion of the outfall consists of 79 m of brick lined cast in place concrete pipe (brick lined to the haunches) and 36 m of CMP pipe.
- All of the bricks are missing from approximately 11 m upstream from the intermediate manhole to 13 m downstream from the intermediate manhole.
  - The concrete pipe is fully exposed in this location and some longitudinal cracking can be seen at approximately 4:00 along this section. Significant spalling at 5:00 along the pipe in this section is also observed.
  - At 6 m upstream from the intermediate manhole, a large piece of the concrete wall has fallen out at the 5:00 position.
- Throughout the remaining 55 m of the brick lined portion of the outfall, bricks are missing along the invert with significant spalling. The brick lined walls throughout this section appear to be in fair condition, however no inspections of the underlying concrete pipe could be observed to verify the concrete conditions.

- At 32 m and 52 m (upstream from the intermediate manhole), bricks are missing from 5:00 to 3:00 on the south side and north side of the pipe respectively.
- A bend exists at 57.9 m (upstream from intermediate manhole).
  - From the bend to the gate chamber no bricks are remaining and there is significant spalling at the invert and 5:00 position.

### **Inspection of the CMP portion of the outfall**

- The CMP portion of the outfall is round with no evidence of deflection and appears to be in fair condition.

The CCTV inspections were coded by UniJet in accordance to the NAAPI Wrc Condition coding indicating the observed pipe defects. These CCTV inspection reports can be found in Appendix A.

### **2.1.2 Archibald Physical Inspection**

KGS Group staff undertook a person-entry physical inspection of the Archibald Outfall on March 8<sup>th</sup>, 2018, for the purposes of completing further structural assessment and the internal dimensions of the pipe.

The inspection began at the flood pump station manhole chamber wall (Station 0.0 m) and concluded at the outfall outlet (Station 115.0 m). Based on the inspection, three segments were observed and measurements were taken in each.

#### **Station 0.0 – 9.75m (Chamber Wall to Bend)**

- This segment of cast-in-place concrete pipe is not brick lined.
- Typical pipe defects within this segment include significant longitudinal cracking (100-150mm depth; large enough to fit a hand) along the pipe invert at the 10:00/11:00 position.
- At approximately 4.0m downstream from the chamber wall, a crack (20mm) is evident in the circumferential direction.
  - Significant spalling of the concrete walls at 5:00 and 7:00 along the entire length of this segment was observed (100mm-125mm depth), with some spots exposing the original wooden forms. The pipe invert appeared deteriorated with concrete missing.
- Field measurements indicated the egg shaped pipe is approximately 2050mm x 2500mm in this segment.

### **Station 9.75m to 67.55m (Bend to Intermediate Manhole)**

- This segment of cast-in-place concrete pipe is brick lined, with the exception of the first two meters of the transition on the north side of the pipe that are not lined.
- Beginning at approximately station 13.0m, there is some brick loss from 4:00 to 6:00.
  - Surface spalling (50 to 100mm depth) appears throughout this segment at 5:00 and 7:00 to the pipe invert.
- At the downstream portion of this segment the pipe defects typically include significant spalling at 5:00 to 7:00, with multiple locations missing bricks on the lower half of the pipe, exposing the concrete walls.
  - The concrete walls appear to have heavy surface spalling (50-75mm depth) where the bricks are missing.
  - It appears there was a concrete floor/lower wall poured in parts of this segment where the bricks are missing.
- At 56.25m to 67.55m, the bricks are completely gone.
  - There is some longitudinal cracking at 4:00 in this location, approximately 50mm in depth.
  - A crack exists along the obvert from 62.05m to 67.55m (avg. depth 25mm; gets larger as you move downstream).
- Field measurements taken indicated the egg shaped pipe within this segment is approximately 2030mm x 2679mm.

### **Station 67.55m to 79m (Intermediate Manhole to Concrete Transition)**

- This segment of cast-in-place concrete pipe is missing all bricks completely and is in poor condition.
- Significant spalling is evident at the lower half of the pipe, with large concrete chunks separating from the walls.
- There appears to be a poured concrete floor. The obvert crack observed upstream of 67.55m continues throughout this segment, from the intermediate manhole to the concrete transition to the CMP (avg. depth 25mm).
- The concrete transition, located at 79m, is in relatively good condition with no evidence of cracking.
- Field measurements indicated the egg shaped pipe within this segment is approximately 2240mm x 2310 mm.

### 3.0 CONDITION RATING

The criterion for categorizing the Archibald Street Outfall is based on the 2001 Sewer Management Study: Technical Memorandum for *Sewer Condition Assessment, Sewer Rehabilitation Design, and Sewer Maintenance Management for the City of Winnipeg*.

The Internal Condition Grade was evaluated by reviewing the CCTV inspections and the person-entry physical inspection. Table 2 indicates the classification of Internal Condition Grades for concrete sewers.

**TABLE 2**  
**ICG RATING CRITERIA FOR CONCRETE SEWERS**

Grade	Implication
5	Collapsed or collapse imminent
4	Collapse likely in the near future
3	Collapse unlikely in the near future but further deterioration likely
2	Minimal collapse risk in the short term but potential for further deterioration
1	Acceptable structural condition

#### 3.1 ARCHIBALD STREET OUTFALL (DOWNSTREAM OF THE FLOOD PUMP STATION)

The outfall consists of two different pipes (type and material) and for the purpose of this assessment has been rated separately. The 2600mm CMP portion of the outfall pipe appears to be in fair condition with no evident structural damage. This portion of the outfall has been given an ICG of 2. The egg-shaped cast-in-place concrete portion of the outfall has significant surface damage (spalling and wear) and chunks of the pipe missing, exposing the original wooden forms. This portion of the outfall is given an ICG of 5. It is likely that continued deterioration of the sewer may lead to a collapse.



## 4.0 REHABILITATION OPTIONS

### 4.1 ARCHIBALD STREET OUTFALL REHABILITATION OPTIONS

Rehabilitation options should be considered to address the current condition of the pipe. Potential rehabilitation options may include internal concrete repairs, segmental lining, and slip lining. The reduction in the cross-sectional area associated with the potential rehabilitation options should consider the capacity of the existing sewer system, specifically the potential limiting capacity of the existing flap gate and positive gate. These gates are approximately 1.22 m X 1.83 m. A hydraulic analysis should be undertaken using the City's existing combined sewer model to determine what impact the proposed rehabilitation options may have on the upstream hydraulics.

Rehabilitation options should consider potential risks, including but not limited to:

- Multiple existing cross sections which may impact lining and repair options;
- Potential of future pipe deflections impacting possible lining options; and
- Potential of future pipe deflections impacting construction of pipe liners

Replacement of the outfall could be considered if rehabilitation is determined to not be a viable solution based on the risks identified above.

## 5.0 COST ESTIMATES

### 5.1 ARCHIBALD STREET OUTFALL

For budgetary purposes, the rehabilitation option is assumed to be a GRP structural liner with multiple profiles. At the design stage, alternate options should be investigated to ensure that the City is receiving the most cost effective and reliable rehabilitation option for the outfall.

ITEM	DESCRIPTION	UNIT	APPROX. QUANTITY	UNIT PRICE	TOTAL
1.0	Site Development and Restoration	lump sum	1	\$60,000.00	\$60,000.00
2.0	Removal of Existing Bricks within outfall	m	47	\$50.00	\$2,350.00
3.0	Supply and Install GRP Liner Profile 1	m	50	\$6,500.00	\$333,125.00
4.0	Supply and Install GRP Liner Profile 2	m	29	\$5,500.00	\$163,487.50
5.0	De-Watering/De-Icing Outfall	lump sum	1	\$10,000.00	\$10,000.00
6.0	New Manhole	l.m.	1	\$25,000.00	\$25,000.00
7.0	Sewer Cleaning	hr	16	\$1,920.00	\$30,720.00
Sub-Total					<b>\$624,682.50</b>
Class 3/Class 4 Estimate Contingency (30%)					\$187,404.75
Engineering Services (15%)					\$93,702.38
Total - GRP Liner Option (GST extra)					<b>\$905,789.63</b>

## **6.0 STATEMENT OF LIMITATIONS AND CONDITIONS**

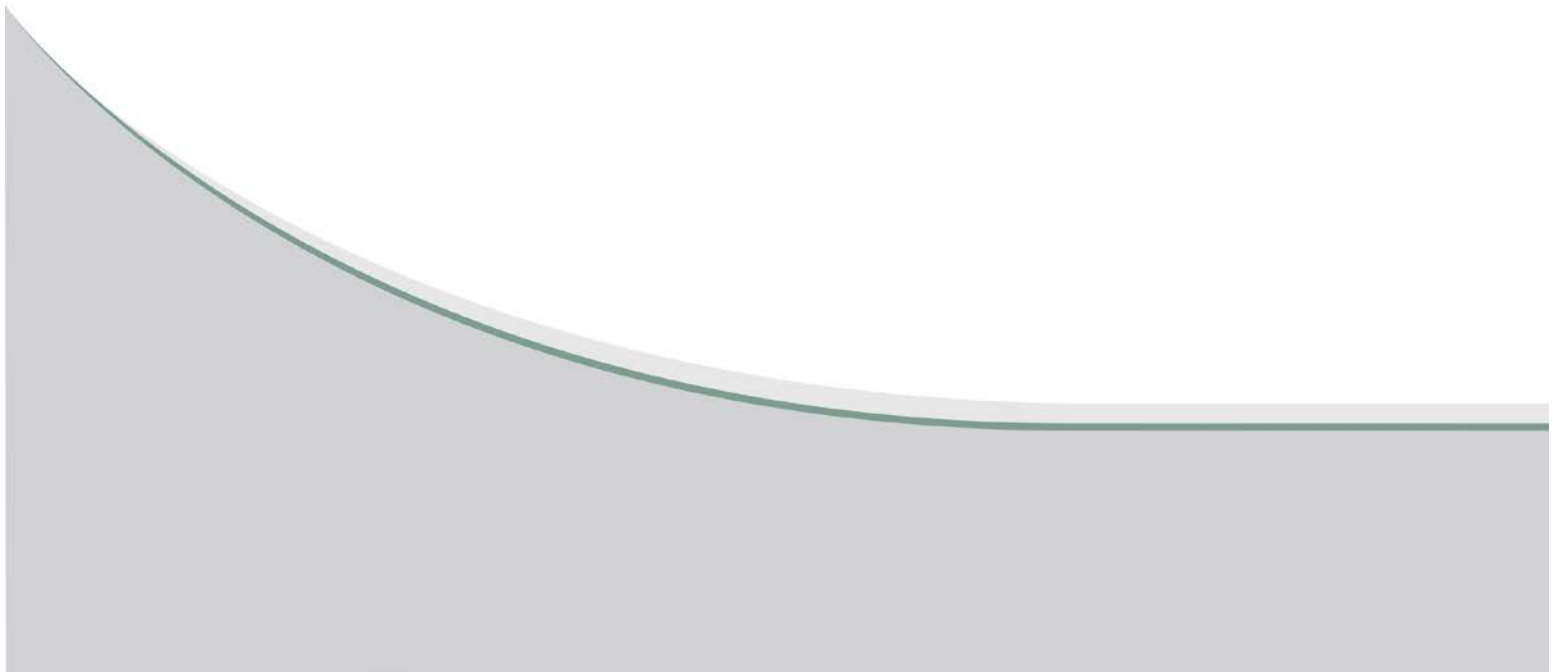
### **6.1 THIRD PARTY USE OF REPORT**

This report has been prepared for the City of Winnipeg to whom this report has been addressed and any use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

### **6.2 CAPITAL COST ESTIMATE STATEMENT OF LIMITATIONS**

The cost estimates included with this report have been prepared by KGS Group using its professional judgment and exercising due care consistent with the level of detail required for the stage of the project for which the estimate has been developed. These estimates represent KGS Group's opinion of the probable costs and are based on factors over which KGS has no control. These factors include, without limitation, site conditions, availability of qualified labour and materials, present workload of the Bidders at the time of tendering and overall market conditions. KGS does not assume any responsibility to the Client, in contract, tort or otherwise in connection with such estimates and shall not be liable to the Client if such estimates prove to be inaccurate or incorrect.

**APPENDIX A**  
**ARCHIBALD STREET OUTFALL SEWER INSPECTION**



# Sewer Management System - Contractor Module V2.1.6

## Sewer Inspection Query

Street Name:  Location:  Entity ID:  Tape ID:

Date Between:  And  Job No:  Survey By:

EntityID	Exported	Street	Location	InspectDate	SurveyedBy	TapeID	JobNo
MA70016	True	75 ARCHIBALD ST	1STMH W OF MISSION STATION TO OUTFALL	02-14-201	UJ-RICH/RIE	BC 1	10302017
MA70019	True	75 ARCHIBALD ST	1ST MH W OF MISSION STATION TO NODE@M	02-14-201	UJ-RICH/RIE	BC 1	10302017

# Sewer Management System - Contractor Module V2.1.6

## Sewer Inspection Report

Surveyed By: UJ-RICH/RIE    Contr. Job No: 10302017    City Job No:    Sewer ID: MA70019979

Date: 02-14-2018    Time: 0949    Street Name: 75 ARCHIBALD ST

Location Description: 1ST MH W OF MISSION STATION TO NODE@MISSION STAT

Start Node: MH70063366    Start Depth: 5.45    End Node: TE70026476    End Depth: 0

Direction: U-UPSTREAM    Height: 2400    Width: 1800    Shape: E-EGG

Material: CO-CONCRETE    Lining:   

Pipe Length: 1    Measured Length: 67.8    Location Code: X-DIFFICULT ACCESS

Purpose: F-CONDITION ASSESSMENT    PreCleaned: Y-YES    Weather: 1-DRY

Tape ID: BC 1    Comments: NO STEEL TAPE

TapeCount	Distance	DefectCode	ContDefect	DiamDimen	ClockAt	ClockTo	IntruPercent	IntruMM	Remarks
00000	0.0	ST							MH70063366
	0.1	WL					05		
	0.1	DE	S2				10		DEFECT WANDERS
	0.1	SSL	S1		04	08			DEFECT WANDERS
	9.9	SSL	F1		04	08			DEFECT WANDERS
	10.0	MC							BRICKI
	10.0	SWL	S3		09	09			DEFECT WANDERS
	10.0	MM	S4		07	05			DEFECT WANDERS
	10.4	H			07				
	10.4	H			05				
	11.4	H			04	05			
	12.2	H			07	08			
	14.6	H			07	08			
	14.6	H			04	05			
	15.6	H			07	08			
	15.6	H			04	05			
	17.6	H			07	08			
	56.4	LL							
	57.6	MM	F4		04	05			DEFECT WANDERS
	57.6	SWL	F3		04	05			DEFECT WANDERS
	57.7	SSL	S6		04	08			DEFECT WANDERS
	57.8	MC							CO
	58.8	H			07	08			
	59.8	H			07	08			
	59.8	H			04	05			
	63.2	H			04	05			
	67.7	DE	F2				20		DEFECT WANDERS
	67.7	SSL	F6		03	05			DEFECT WANDERS
	67.8	MH							TE70026476
01120	67.8	FH							

# Sewer Management System - Contractor Module V2.1.6

## Sewer Inspection Report

Surveyed By: UJ-RICH/RIE    Contr. Job No: 10302017    City Job No:    Sewer ID: MA70016004

Date: 02-14-2018    Time: 1011    Street Name: 75 ARCHIBALD ST

Location Description: 1STMH W OF MISSION STATION TO OUTFALL@SEINERIVER

Start Node: MH70063366    Start Depth: 5.45    End Node: OUTLET 1    End Depth: 0

Direction: D-DOWNSTREAM    Height: 2400    Width: 1800    Shape: E-EGG

Material: CO-CONCRETE    Lining:

Pipe Length: 1    Measured Length: 52.7    Location Code: X-DIFFICULT ACCESS

Purpose: F-CONDITION ASSESSMENT    PreCleared: Y-YES    Weather: 1-DRY

Tape ID: BC 1    Comments: NO STEEL TAPE

TapeCount	Distance	DefectCode	ContDefect	DiamDimen	ClockAt	ClockTo	IntruPercent	IntruMM	Remarks
00000	0.0	ST							MH70063366
	0.1	DE	S2				05		DEFECT WANDERS
	0.1	WL					05		
	0.1	SSL	S1		03	09			DEFECT WANDERS
	0.1	H			04	08			
	1.1	H			04	08			
	2.1	H			04	08			
	11.4	B			03				
	12.8	DC		2400					CIRCULAR
	14.2	SSL	F1		02	10			DEFECT WANDERS
	14.2	MC							CMP
	14.2	ESM	S5		06	06	05		DEFECT WANDERS
	14.2	SWM	S3		03	09			DEFECT WANDERS
	14.2	SSM	S4		09	03			DEFECT WANDERS
	51.2	SSM	F4		08	04			DEFECT WANDERS
	51.2	DE	F2				00		DEFECT WANDERS
	51.2	SWM	F3		04	08			DEFECT WANDERS
	51.2	ESM	F5		06	06	05		DEFECT WANDERS
	52.7	MH							OUTLET 1
00920	52.7	FH							

**KGS**  
GROUP  
CONSULTING  
ENGINEERS

