Report for:

CITY OF WINNIPEG

-WATER AND WASTE DEPARTMENT-

--- Final Copy ---

WASTEWATER LIFT STATION CONDITION ASSESSMENT PHASE II

Document II: St. Charles Lift Station Assessment

Date: March 16, 2020
City File No.: S-1095
MPE Project No.: 8400-001-00

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MPE ENGINEERING LTD.

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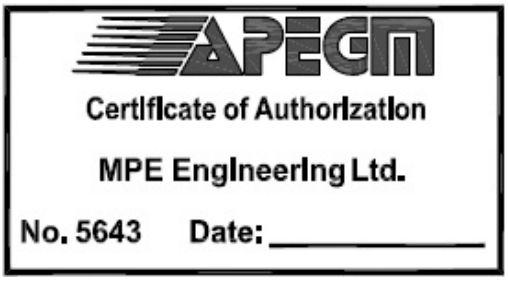

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1.0 Introduction

1.1 Background

MPE Engineering Ltd. (MPE) conducted a visual inspection of the St. Charles Lift Station on January 31, 2019. City of Winnipeg (the City) staff accompanied MPE for the duration of the inspection. The purpose of the site inspection was to assess the current condition of the facility and identify components that will require replacement or maintenance. The condition assessment will assist the City in making informed decisions on short and long-term maintenance requirements of the facilities. The scope of the condition assessment includes the following:

- Detailed assessment of the following **Asset Categories**:
  - Facility (including site, structural, and HVAC systems),
  - Pumps and motors,
  - Electrical and communications,
  - Pipe work and valves,
  - Power, and
  - Force mains.
- Review of code compliance, occupant safety, and accessibility.
- Recommendations and cost estimates for rehabilitation projects.
- Recommendations on any follow up re-inspection work.

This document provides an assessment of the current infrastructure in terms of the performance and condition of individual lift station components, review of lift station components with respect to the latest codes and standards, as well as a hydraulic and capacity review. The assessment identifies components that require replacement or maintenance along with associated estimation of cost.

The assessments were based on **Condition Assessment Forms** that were developed from our site investigations, discussions with Operation Staff, and review of available documents. These forms were used to assign ratings to each component of the lift station in order to develop the cost estimates and recommendations.

1.2 Limitations

Inspections were limited to cursory visual review of lift station components. Analysis of below grade infrastructure that was not accessible has not been included. Buried pipelines were not exposed or reviewed. Assessment of below grade infrastructure has been based on operational comments from City staff and life cycle estimations. Destructive testing methods were not conducted.

1.3 Design Standards & Guidelines

MPE prepared this assessment in accordance to the standards and guidelines listed in **Appendix G**.

1.4 Methodology

The condition assessment consisted of the following:

- *Review of available documents and drawings.* Documents were reviewed to determine if any previously identified issues were unresolved or remain unaddressed. Drawings were examined in order to understand intent of design, design capacity, and to review component compliance with applicable codes.
- *Site inspections of each facility.* Qualified personnel conducted inspections. Photographs of each site were taken and field assessment forms were completed. City of Winnipeg staff accompanied MPE personnel and

provided operational information, background, and the history of each facility. Additionally, City staff identified the areas of operation and maintenance concern.

- *Informal interviews with Operations Staff.* Interviews were conducted to collect further information about each site and to identify issues that are of importance to the maintenance staff. Staff members were also able to provide valuable historical information about deficiencies identified at each site.
- *Completion of Condition Assessment Forms.* The collected information was compiled and reviewed to identify deficient items. A system of rating the condition of each component was developed. Estimated costs for correcting the deficiencies were assigned to each deficiency. Recommendations were developed based on the condition of the component, importance of the component, as well as safety and code compliance. Results were compiled into the Condition Assessment Forms.

1.5 Evaluation Criteria

The Asset Categories identified in Section 1.1 were evaluated based on the following Likelihood Indicators:

- ***Current Physical Condition*** – Assesses the actual condition of the component.
- ***Fitness for Purpose*** – Assesses the component ability to deliver the design performance required consistently.
- ***Maintenance and Operability*** – Assesses whether optimal maintenance and operation practices occur.
- ***Third Party and Environmental Damage*** – Assesses vulnerability to external hazards.

Note: The "Demand Condition" indicator, used in previous assessments conducted by the City, was removed from this assessment and incorporated into Fitness for Purpose. The "Third Party and Environmental Damage" indicator was removed from Facility assessments but remains an indicator for Force main assessments.

Table 1.1 provides a general overview of the scoring matrix that was used to asses each component. The scoring criteria was adjusted to suit each asset category, but generally utilized the following format:

Table 1.1 : CONDITION RATING LEGEND

SCORE	5	Emergency / Critical	Component is not functional or is causing an unsafe condition
	4	Poor / Unsatisfactory	Component has extensive deficiencies that may affect plant operations. High level of maintenance may be required
	3	Fair	Component is able to function for its intended use. Additional maintenance may be required
	2	Good	Only minor deficiencies. Routine maintenance should be sufficient for foreseeable future
	1	Excellent	Component is in new condition

1.6 Condition Assessment Forms

The Condition Assessment Forms are the basis of our assessment. The forms compile information gained through site visits, discussions with Operations staff, review of documents, and engineering experience. A sample form is shown in Figure 1.1. Individual assessment forms were generated for each piece of equipment assessed. The completed assessment forms have been appended to this report.

Figure 1.1 – Condition Assessment Form Sample

Project No.: 8400-001-00
Tag: **IC_101_Panel**
Facility: Metcalfe Lift Station
Assessment Page 1 of 1

CONTROL PANEL CONDITION ASSESSMENT FORM

Assessor: Richard Ofstie
Date: 29-Jun-19
Populate Date
Asset ID: 14331

Asset Category

Likelihood Indicator Scores

Likelihood Indicators

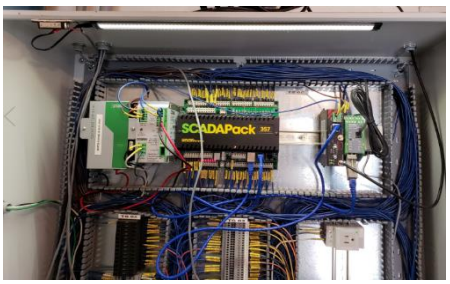
Asset Consideration

Notes & Comments

Assessor's Rating

Recommendations with Cost Estimates

Pre-Established Weighting

SECTION	ITEM	DATA		Assessment Scores: Current Physical Condition	Fitness For Purpose			YEAR INSTA	EXPECTED SE LIFE	REMAINING SERVICE LIFE
Equipment Tag: IC_101_Panel Description: IC_101_Panel	GENERAL	Location:	Drywell, Main Level	3	1			2013	30	24
		Description:	IC_101_Panel							
		Function:	Station Monitoring							
		PLC Processor:	SCADAPack 357							
		UPS Protection:	Yes	Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)				5
	Current Physical Condition	**Equipment Visual Ins** *Issues for Discussion:*	Rating 1 (New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	1	0.1	*NOTES & COMMENTS:* Equipment appears to be in "Good" condition. Equipment is not rated for classified locations. Wiring methods do not follow provided raceway. Panduit cover is removed. No redundency.				
		Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4					
		Control Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	3	0.1					
		Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.4					
	Fitness for Purpose	**Controls Functioning as Expected:** *Issues for Discussion:*	Rating 1 (Always) Rating 2 (More than half of time) Rating 3 (Half of the time) Rating 4 (Less often than half) Rating 5 (Never)	1	0.3	*RECOMMENDATIONS:* Incorporate redundent control for the lift station. Upgrade HVAC system. Install panduit cover.	*COST ESTIMATE* $ 45,000.00			
		Panel is Appropriately Designed: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	3	0.1					
		Control Logic is Appropriate for Installation: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	1	0.3					
		Communications Equipment is Appropriate: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	1	0.1					
		Equipment Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	2	0.2					
	PHOTOGRAPHS									

2.0 General Overview

2.1 Location

The St. Charles Lift Station is located near the intersection of Sansome Avenue and Gagnon Street. It is surrounded by residential land.

2.2 General

The lift station was originally constructed in approximately 1960. The station has gone through numerous renovations over the years and currently services a large commercial / residential area. The station underwent major upgrades in the 1990's. Table 2.1 provides a brief overview of the Station.

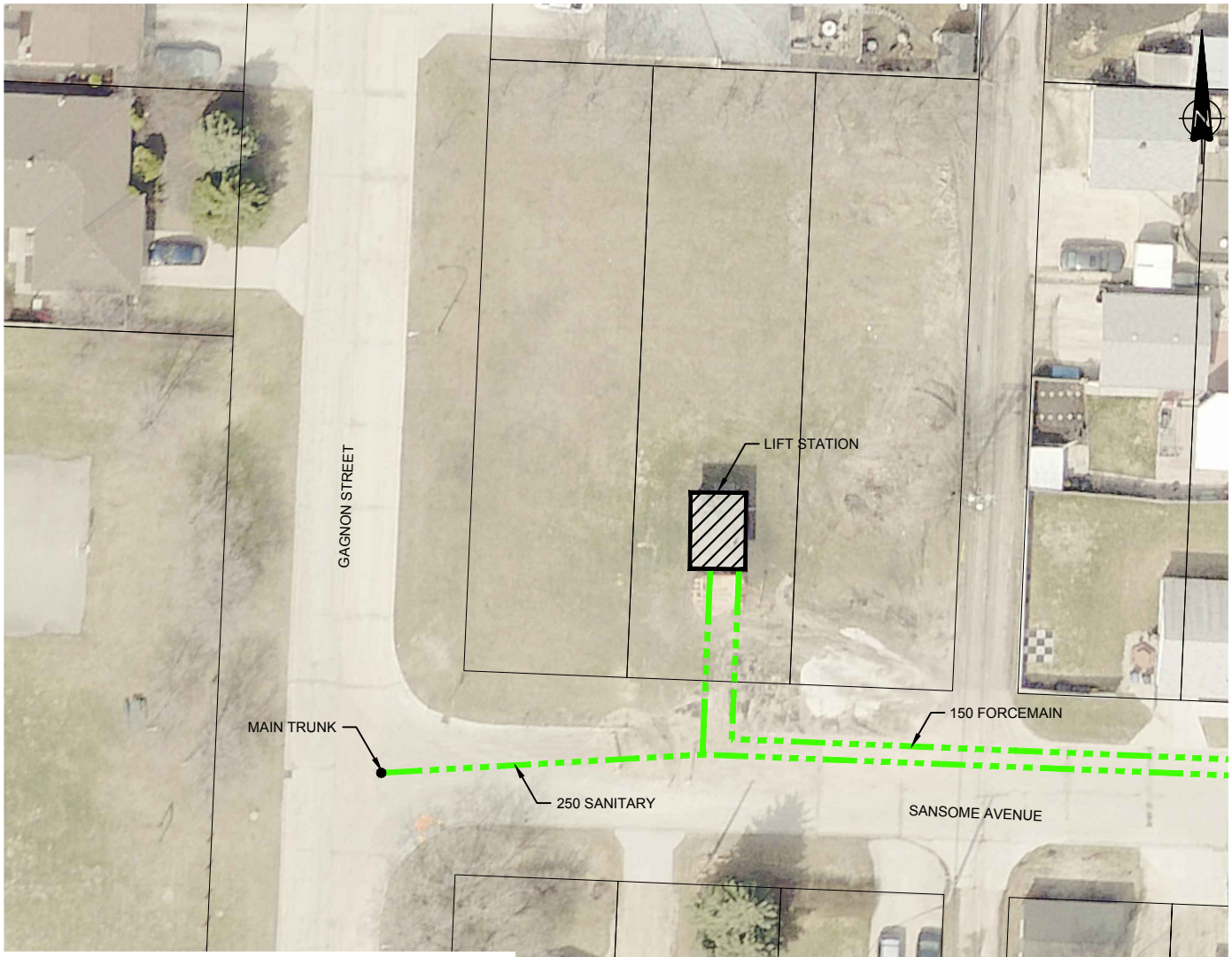
Table 2.1: St Charles Lift Station Overview

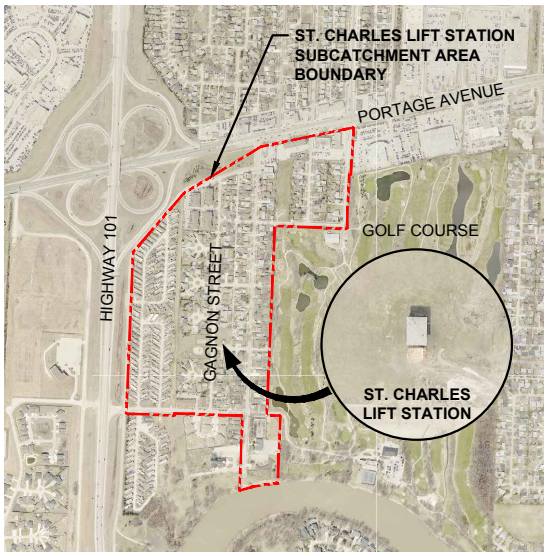
YEAR CONSTRUCTED	1960	Major Reno: 1993
LOCATION	Sansome Avenue and Gagnon Street	
CONFIGURATION	Wet Well / Dry Well	
PUMPING CAPACITY	20 L/s	
TYPE OF PUMPS	Dry Pit Solids Handling	
PUMP HORSEPOWER	P101: 10 HP, P102: 10 HP	
BACKUP GENERATOR	Mobile Generator - Full Station	
VENTILATION	Dry Well: Intermittent, Wet Well: Intermittent	

The lift station includes a transfer switch that can connect to the City's mobile generator which can power the full station. The station primary components are aging and in need of upgrading to ensure reliable usage going forward. The primary structure remains in "Fair" condition, but the secondary structural members and principal equipment are at the end of their service life, and will require upgrades in the near future. Section 11 summarizes the recommended upgrades.

St. Charles Site Location – Google Earth

Figure 2.1 provides an overall site location plan of the St. Charles Lift Station facility.





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LIFT STATION ASSESSMENTS 2018-2019
ST. CHARLES LIFT STATION
LOCATION PLAN

SCALE: 1:500	DATE: AUGUST 2019	JOB: 8400-001-00	FIGURE: 2.1

3.0 Information and Regulatory Review

3.1 Historical Data Review

3.1.1 Data Collection

The City of Winnipeg records estimated average and peak incoming flow into the lift station wet well. Estimated flows were provided by the City of Winnipeg.

3.1.2 Record Drawings, Reports, & Manuals

The following data, plans, reports, and manuals were compiled and reviewed to complete this report:

- St. Charles Wastewater Pumping Station Upgrading – Record Drawings; The City of Winnipeg Works and Operations Division Waterworks Waste and Disposal Department; 1998
- St. Charles Lift Station Electrical and Control Upgrading – Record Drawings; The City of Winnipeg Works and Operations Division Waterworks Waste and Disposal Department; 1995
- St. Charles Sewage Pumphouse Structural & Equipment – Record Drawings; UMA; 1960
- St. Charles Sewage Pumphouse Site Plan & Architectural – Record Drawings; UMA; 1960
- St. Charles Sewage Pumphouse Electrical – Record Drawings; UMA; 1960
- Local Water and Sewer Drawings; City of Winnipeg
- Catchment Areas and Information; City of Winnipeg
- LIFT_STN_SERVICE_AREAS.gws – Lift Station Catchment Areas

3.1.3 Missing or Conflicting Data

The material of the force main piping was not evident on the record drawings. Asbestos cement piping was used for the purposes of determining pipeline hydraulic losses in this report.

4.0 Sewage Production

4.1 General

The service area and design flows were generated based on discussion with the City of Winnipeg representatives along with the design criteria presented in the City of Winnipeg Wastewater Flow Estimation and Servicing Guidelines; 2018.

4.1.1 Catchment Area

The catchment area for the St. Charles Lift Station was provided by the City from the LIFT_STN_SERVICE_AREAS.gws workspace and consists of primarily Single Family Dwellings with small areas of Multi Family Dwellings and Commercial areas. The catchment area is located primarily south of Portage Avenue, east of Highway 101 and west of Glendale Golf & Country Club. Figure 4.1 illustrates the sub-catchment area for the St. Charles Lift Station.

4.1.2 Peaking Factor

To account for the diurnal fluctuations in sewage flows, peak hourly flows are calculated based on the peaking factor derived from the Harmon equation:

$$\text{Harmon's Peaking Factor} = 1 + 14 / (4 + P^{1/2})$$

where: P = design contributing population in thousands

St. Charles Wet Well

ST. CHARLES	
ROW LABELS	COUNT
APARTMENTS	1
BEVERAGE HOTEL	1
CEMETERY	1
CHURCH	2
COMM/RETAIL WH CTRE	1
COMPLETE AUTO DEALER	4
CONDO-COMPLEX	2
CONDO-ROWHOUSE	40
DETACHED SINGLE DWELLING	172
GOLF COURSE	1

ST. CHARLES	
ROW LABELS	COUNT
MOBILE HOME	1
MOTEL	1
MULTI FAMILY CONVRSN	1
RESTAURANT	1
SCHOOL	1
STORE	1
VACANT PARK	8
VACANT RESIDENTIAL 1	7
GRAND TOTAL	246

LEGEND

ST. CHARLES SUBCATCHMENT
AREA=29.2ha (72.09 acres)

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LIFT STATION ASSESSMENTS 2018-2019
ST. CHARLES LIFT STATION
SUBCATCHMENT AREA

SCALE: 1:7500	DATE: APRIL 2019	JOB: 8400-001-00	FIGURE: 4.1

4.2 Wastewater Flows

4.2.1 Historical Flows

Historical wastewater flow data was not available for the St. Charles Lift Station. Therefore, the following assumptions have been used to estimate the current and projected ultimate capacities for the facility:

- Land use consists of Single Family Dwellings, Multi Family Dwellings, and Commercial Areas.
- Catchment area is approximately 29.2 ha.
- Average dry weather wastewater flow as follows
  - Residential areas – 270 litres per capita day (Lpcd).
  - Commercial areas – 16,800 L/ha/day.
- Extraneous flow allowance as follows:
  - Groundwater infiltration – 2,200 L/ha/day
  - Manhole infiltration – 12 L/min/manhole
    - Residential manhole density – 1.6 manholes/ha
    - Commercial/industrial manhole density – 1.0 manholes/ha
  - Weeping tile flow – 4.55 L/min/service connection
    - Only included in residential areas constructed prior to 1990
- No anticipated future developments to be serviced by the lift station.

Table 4.1 illustrates the estimated wastewater flows.

TABLE 4.1: ESTIMATED WASTEWATER FLOWS

SUBCATCHMENT DESIGN FLOW								
LAND USE	AREA (HA)	DWELLING DENSITY (DWELLINGS/HA)	DWELLINGS (NO.)	POPULATION DENSITY (PPL/DWELLING)	EQUIVALENT POPULATION	HARMON PEAKING FACTOR	AVERAGE DRY WEATHER FLOW (LPCD)	AVERAGE DRY WEATHER FLOW (L/SEC)
Single Family Dwelling	23.2	12.29	285.1	3.05	870	-	270	2.7
Multi-Family Dwelling	4.4	74.13	326.2	2.30	750	-	270	2.3
Subtotal	27.6				1,620	3.655	270	5.1
							(L/HA/DAY)	(L/SEC)
Commercial	1.6	-	-	-	-	-	16,800	0.3
Subtotal	1.6						16,800	0.3
Total:	**29.2**	-	-	-	-	-	-	**5.4**

LAND USE	PEAK DRY WEATHER FLOW		EXTRANEOUS FLOW CONTRIBUTIONS				PEAK WET WEATHER FLOW
			GROUNDWATER	MANHOLE		WEEPING TILE	
	(LPCD)	(L/SEC)	(L/SEC)	(MH/HA)	(L/SEC)	(L/SEC)	(L/SEC)
Single Family Dwelling	-	-	0.6	1.6	7.4	21.6	-
Multi-Family Dwelling	-	-	0.1	1.6	1.4	-	-
Subtotal	987	18.5	0.6	-	8.8	21.6	49.5
	(L/HA/DAY)	(L/SEC)	(L/SEC)	(MH/HA)	(L/SEC)	(L/SEC)	(L/SEC)
Commercial	28,100	0.5	0.0	1.0	0.3	-	-
Subtotal	28,100	0.5	0.0	-	0.3	-	0.5
Total:	-	**19.0**	**0.6**	-	**9.2**	**21.6**	**50.1**

The estimated average dry weather flow is 5.4 L/sec, the peak dry weather flow is 19.0 L/sec, and the peak wet weather flow is estimated to be 50.1 L/sec.

4.2.2 Projected Flows

No further expansion is anticipated for the catchment area for the St. Charles Lift Station.

5.0 Lift Station Hydraulic & Capacity Review

5.1 Background

The lift station houses two (2) dry pit solids handling pumps. Both pumps are required to operate under normal conditions. The pumps start at a level of 2500 mm and stop at a level of 500 mm. Table 5.1 provides a summary of the pumps utilized at the St. Charles Lift Station.

TABLE 5.1: ST. CHARLES LIFT STATION PUMPING SUMMARY

PUMP	Pump Type	MANUFACTURER	MODEL	POWER (HP)	YEAR OF INSTALL	DUTY POINT		DISCHARGE SIZE (mm)
						FLOW (L/sec)	TDH (m)	
PUMP 1 - P-101	DRY PIT SOLIDS HANDLING	AURORA	664 SF	10	1993	18.93	9.6	150
PUMP 2 - P-102	DRY PIT SOLIDS HANDLING	AURORA	664 SF	10	1993	18.93	9.6	150

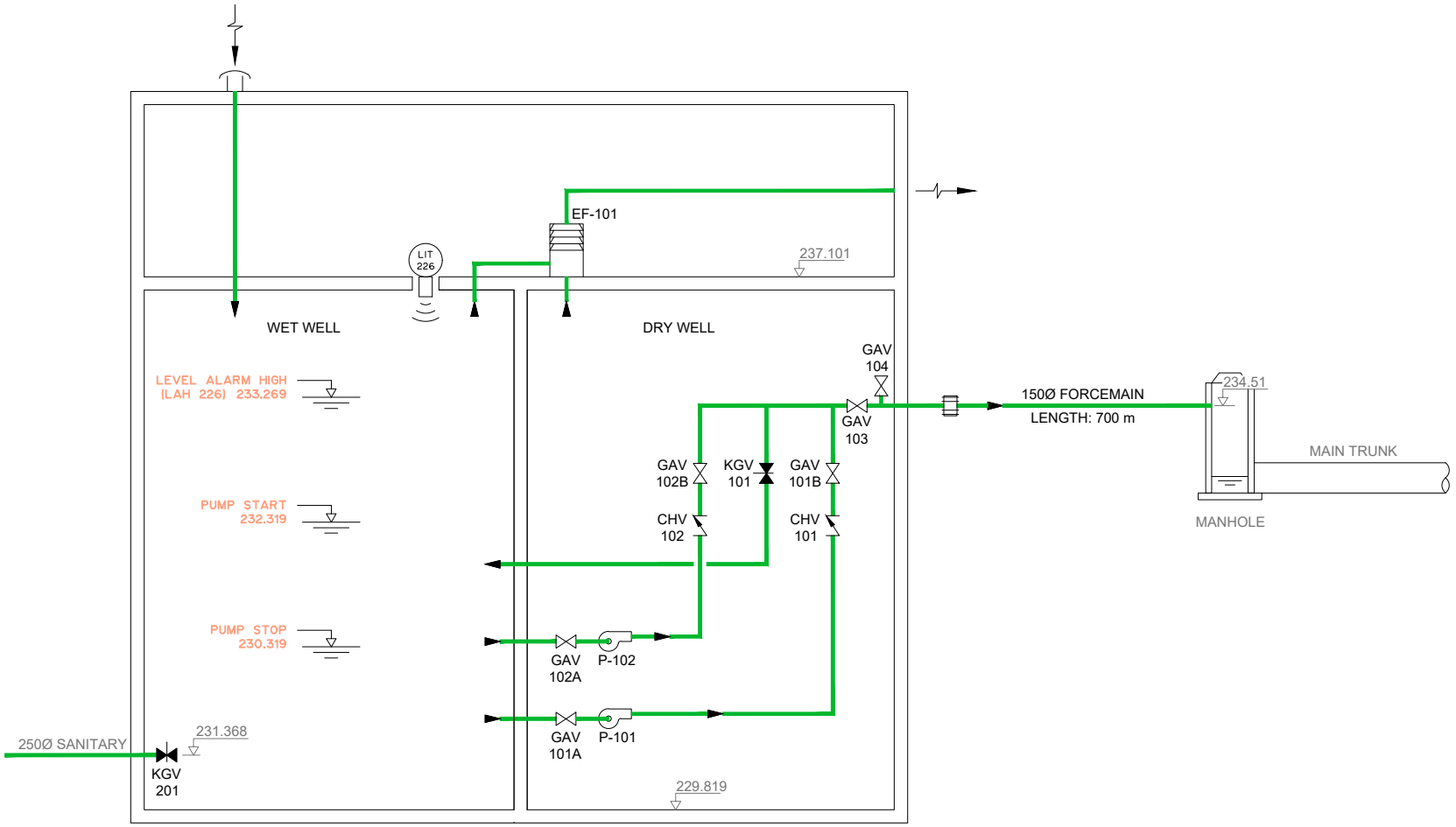
*Based on duty point in Pump Manufacturer's datasheet

P-101 and P-102 are identical Aurora 664 SF pumps rated for 18.93 L/sec at a Total Dynamic Head (TDH) of 9.6 m and operate at a constant speed. Operational staff noted that there are concerns with the pumps plugging constantly with rags, rocks and debris. The pumps run continuously for long periods after rainfall events.

A 150 mm diameter force main is used to discharge sewage from the St. Charles Lift Station. The force main connects to a manhole located north of the intersection of Isbister Street and Portage Avenue.

5.1.1 Process Flow Diagram

Figure 5.1 provides an overall process flow diagram of the St. Charles Lift Station.



P-101
- DUTY POINT: 18.93 L/s @ 9.6 m
- 10 HP. 1200 RPM
- 575 VAC/3 PH/60 Hz

P-102
- DUTY POINT: 18.93 L/s @ 9.6 m
- 10 HP. 1200 RPM
- 575 VAC/3 PH/60 Hz

Winnipeg

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LIFT STATION ASSESSMENTS 2018-2019

ST. CHARLES
PROCESS FLOW DIAGRAM

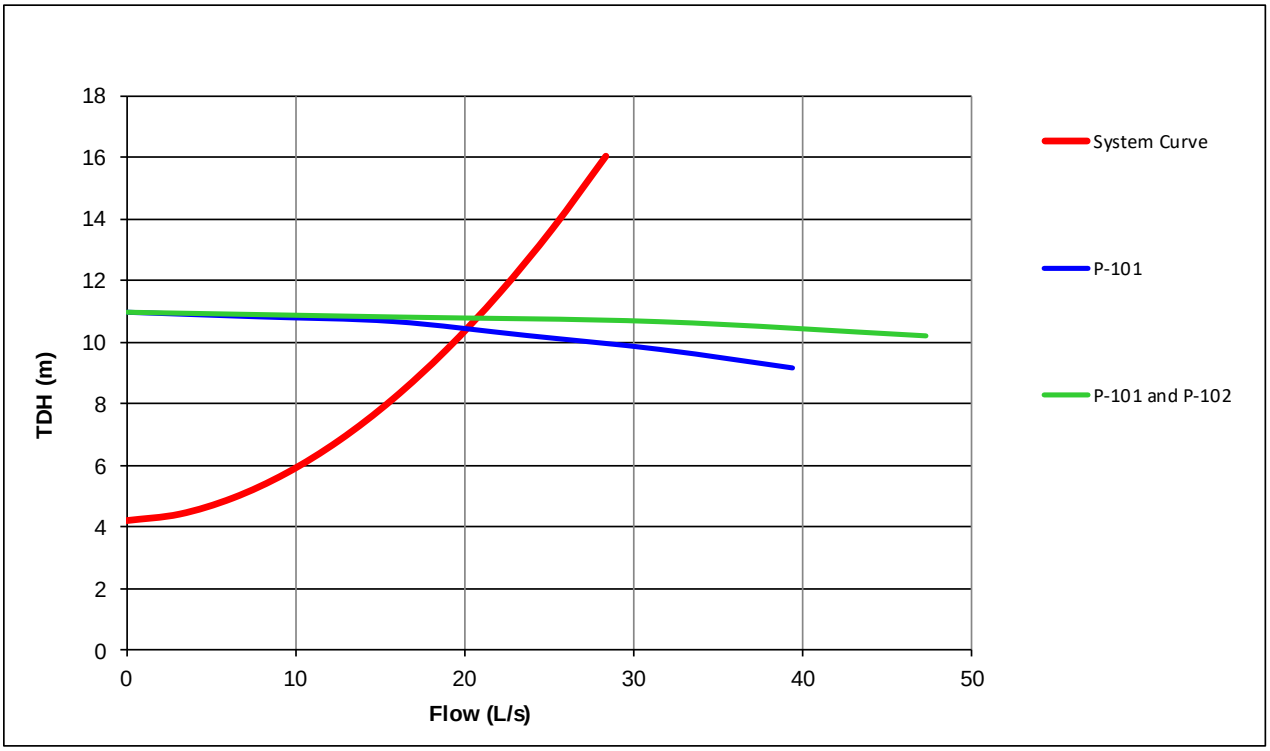
SCALE: NTS	DATE: SEPT 2019	JOB: 8400-001-00	FIGURE: 5.1

5.2 Hydraulic Analysis

5.2.1 Pump Capacity Review

To develop the lift station system curve, the piping system was analyzed using the Darcy – Weisbach formula. The anticipated pump flows are determined by the intersection of the system curve with the respective pump curves. The lift station system curve versus theoretical pump performance chart is illustrated below in Figure 5.2.

Figure 5.2: Lift Station Curve vs. Pump Performance Curve



The theoretical flows that can be obtained with one pump and two pumps in operation are 20 L/s and 21 L/s, respectively.

5.2.2 Pumping Requirements Review

The design of the lift station pumping system must incorporate standby capacity such that when the largest pump is out of service the station is capable of handling the peak inflow rate. The rated capacity should be equal to or greater than the peak wet weather flow rate of 50.4 L/sec. The maximum pumping capacity of the lift station is approximately 21 L/s with both pumps in operation. The 'rated' capacity of the lift station with the largest pump being out of service is currently 20 L/sec. Based on the estimated peak wet weather flow; the pumping system is not currently capable of meeting the peak influent flow requirements.

5.2.3 NPSHA Analysis

A Net Positive Suction Head Available (NPSHA) analysis was performed to review the lift station suction piping system. NPSHA is the maximum absolute pressure available at the suction port of the pump above vapour pressure.

Centrifugal pumps are not capable of handling large quantities of vapour, so it is critical that there is sufficient absolute pressure on the suction side of the pump to prevent vaporization or flashing in the impeller.

An NPSHA analysis was performed at various levels in the lift station wet well. The analysis indicated that there is sufficient NPSHA to prevent cavitation. The results of the analysis are summarized in Table 5.2.

TABLE 5.2: SUCTION LINE NPSHA ANALYSIS

CONDITION	WET WELL LEVEL (mm)	PUMP SPEED (%)	FLOW (L/s)	SUCTION LINE TOTAL DYNAMIC HEAD (m)	NPSH REQUIRED (m)	NPSH AVAILABLE AT PUMP INLET (m)	NPSH EXCESS AVAILABLE (m)
PUMP STOP	500	100	18.93	0.35	6.10	9.20	3.11
PUMP START	2500	100	18.93	0.35	6.10	11.20	5.11

5.2.4 Force Main Review

A 150 mm diameter force main is used to convey sewage from the St. Charles Lift Station. The length of the force main is 700 m. The force main was installed in 1960 and has a volume of approximately 12 m^3. Based on the estimated average and peak dry weather flows of 5.37 L/s and 19.0 L/s, the average retention time in the force main ranges from 11 to 38 minutes which is below the maximum recommended retention time of 4 hours.

An analysis of the force main was performed to confirm whether the force main piping is adequate to carry the flow rates from the lift station. Velocities were calculated for theoretical pumping rate scenarios at the St. Charles Lift Station. The results are summarized in Table 5.3.

TABLE 5.3: FORCE MAIN VELOCITY

DESCRIPTION	ONE PUMP THEORETICAL	TWO PUMPS THEORETICAL
FLOW (L/s)	20.0	21.0
FORCE MAIN VELOCITY (m/s)	1.13	1.19

The St. Charles force main was found to be adequately sized for the flows from the lift station and the velocities are within the acceptable range of 0.6 m/sec to 1.6 m/sec.

5.3 Wet Well Sump Analysis

The fill time of the wet well from the pump stop level to the pump start level is approximately 16 minutes. Best industry practices state that the filling time based on average flow should not exceed 30 minutes to avoid anaerobic conditions. The existing wet well meets the maximum fill time requirements and is adequately sized for the incoming flows.

5.3.1 Pump Cycling Review

The wet well size was modeled for tank level versus pump cycle time. Average dry day flow results in approximately three (3) pump cycles per hour. Peak dry day flow results in approximately five (5) pump cycles per hour. Peak wet weather flow will result in both pumps operating continuously for the duration of the storm event. The maximum allowable starting and stopping intervals for a 10 HP pump are 14 cycles per hour. The pump cycles are within the allowable limits and the pump capacity is acceptable for the volume of the wet well. If it were determined that

pump cycles were more than the allowable motor starts per hour, variable frequency drives (VFD's) can be fitted to the pumps to mitigate this issue.

5.4 Wet Well Flow Path Review

Sewage enters the south side of the wet well through a 250 mm diameter PVC pipeline and is directed to the pump suction lines located on the north side of the wet well. Concrete benching has been installed on the south side of the wet well. The benching is 800 mm high by 100 mm long and prevents solids build up in the edges of the wet well. The 150 mm diameter pump suction lines are located 250 mm from the bottom of the wet well. Operational staff noted that there are no noticeable issues with solids buildup in the wet well.

5.5 Pump Control Strategy Review

The following provides a brief outline of the control narrative for the lift station:

5.5.1 General

- Typically, the facility is operated in Automatic mode.
- Pumps can be operated either in Manual or Automatic mode.
- There are no local motor emergency stops in the dry well lower level.

5.5.2 Manual Mode

- The pumps can operate manually through a hand/off/auto switch that can bypass the controller and operate the pump.

5.5.3 Automatic Mode

- In the Automatic mode the station pump controller operates the pumps based on level.
- The pumps will start when the level in the wet well rises above the "Pump Start Level" of 2500 mm.
- If any pump fails to operate correctly in Automatic mode, then a pump failure alarm will be triggered, the failed pump will automatically shut down, and the alternate pump will automatically start to replace the failed pump.
- The pumps shut down at the "Pump Stop Level" of 500 mm.

The control strategy used at the St. Charles Lift Station is similar to the control strategy used at other lift stations throughout the City. The control strategy is well understood by the Operators and has proven to be a successful method of operation.

5.6 Conclusions and Recommendations

The hydraulic and capacity assessment of the St. Charles Lift Station yielded the following conclusions:

- There are no issues with NPSHA or excessive pump cycling in the pumping system.
- The pumping system is capable of meeting the peak dry weather influent flow requirements, however the pumping system is not currently capable of meeting the peak wet weather influent flow requirements.
- The existing wet well meets the maximum fill time requirements and is adequately sized for the incoming flows.
- The force main was found to be adequately sized for the flows from the lift station and the velocities are within the acceptable range.

6.0 Facility Condition Assessment

6.1 Background

The following provides a condition assessment of the building facility for the St. Charles lift station in terms of the condition of individual system components and code and regulation compliance. The assessment identifies existing infrastructure that requires replacement, maintenance, or upgrades. A condition rating has been given to the components to identify the condition and cost estimates have been developed. Recommendations have been developed in order to assist the City in prioritizing future projects. The Condition Assessment Forms have been appended to this report.

6.2 Code Review

A review of the lift station was undertaken to verify compliance with the National Building Code. Table 6.1 provides a summary of the code review.

TABLE 6.1: ST. CHARLES LIFT STATION - CODE REVIEW

YEAR CONSTRUCTED	1960	Major Reno: 1996
BUILDING FOOTPRINT AREA (m2)	<5m2	
LOCATION	435 Sansome Avenue at Gagnon Street	
BUILDING CLASSIFICATION	Non Combustible / Combustible	
ROOFING MATERIAL	Asphalt Shingle	
MAJOR OCCUPANCY CLASSIFICATION	F-3 - Low Hazard Industrial	
OCCUPANT LOADING	5 max.	

ITEM	REQUIREMENT	CODE COMPLIANCE	CODE REFERENCE / NOTES
BARRIER FREE ACCESS	Not Required	n/a	*NBC - 3.8- A3.8.1.1*
MAIN FLOOR EXITS	1 required	YES	*NBC - 3.4.2.1 (A) - Floor area < 200m2*
TRAVEL DISTANCES	Less than 15 m	YES	*NBC - 3.4.2.1 (A) - F-3 Occupancy*
MEZZANINE EXIT	Less than 15 m	n/a	*NBC - 3.4.2.2*
GUARDRAILS / HANDRAILS	0.75 kN/m lateral load	YES	*NBC - 4.1.5.14 -*
IMPORTANCE FACTOR	Post Disaster	NO	*NBC - 4.1.2*
EGRESS PATHS	1100mm min. width	YES	*NBC - 3.4.3.2*
NOISE DECIBLE	< 85 dBA	YES	*OH&S Part 8. -*
MONORAIL CERTIFICATION		--	*No inspection certification noted*
SPRINKLER SYSTEM	Not Required	n/a	*NBC - 3.2.2*
EMERGENCY LIGHTING	Required	NO	*NBC - 3.2.7.3*
EXIT SIGNAGE	Illuminated over door	NO	*NBC - 3.4.5.1 (2)*
SMOKE ALARM	Not Required	n/a	*NBC - 3.2.4.11*
FIRE ALARM	Required	n/a	*NBC - 3.2.4*
HAZARDOUS SUBSTANCE	**CAPACITY (Litres)**	**REGESTERED**	**CODE REFERENCE / NOTES**
DEISEL (Fuel Oil) - Generator Room	None	n/a	*Registration with Ministry of Environment is not required*
DEISEL (Fuel Oil) - Pump Station	None	n/a	*Registration with Ministry of Environment is not required*
-Hazardous Substances and Waste Dangerous Goods Regulations recommends registration for tank capacity > 4000 Litres-			
SECURITY	**SITE SECURE**	**BUILDING SECURE**	**NOTES**
PUMP STATION	No	Yes	*No perimeter fence enclosing the lift station*

6.3 Site Conditions

The St. Charles Lift Station is located near the intersection of Sansome Avenue and Gagnon Street. The lift station superstructure is roughly 11 meters from the curb of Sansome Avenue in the south half of a corner lot field.

6.3.1 Site Access and Parking Lot

The lift station can be easily accessed from Sansome Avenue via a small gravelled driveway and parking area. The gravel has mostly eroded away.

6.3.2 Site Grading & Landscaping

Due to snow cover during the inspection, the site grading conditions were not able to be observed. A Google Maps – Street View image, however, reveals ponding against the side of the structure. Landscaping consists of a large grass area kept mowed.

St. Charles Site Grading – Google Maps

6.3.3 Security and Signage

There is no perimeter fencing around the station. The building does not have windows and is secure. The electric meter located on the exterior of the building could be subject to vandalism. Signage identifies the building as a City of Winnipeg facility, but does not provide emergency contact information.

6.4 Foundations

6.4.1 Foundation Slab

The St. Charles Lift Station foundation consists of a cast-in-place concrete wet well/dry well configuration. The concrete wet well and dry well act as the foundation for the lift station building. The base is approximately 7.3m below grade. The concrete is very etched, worn, and aged but remains in sound condition with no structural concerns. The sump pit is functional with good floor slope for drainage to the sump.

6.4.2 Foundation Walls, Columns, and Beams

Sections of the lower wet well/ dry well dividing wall have been modified. The pump inlet pipe appears to have been relocated and the old section has been patched over. Hairline cracking was noted in various sections of the wall. No structural concerns were noted.

6.4.3 Wet Well

The wet well access is located within the lift station building resulting in potential for H2S to enter the building. This can cause an unsafe work environment, and lead to aggressive corrosion in the building components. A bolt down gas-tight hatch would help eliminate this issue; however, the close proximity to the wall would require additional modifications for proper installation. Relocating the access to the exterior of the building is recommended for Code compliance.

Access to the well is not recommended in any condition unless full harnessing and safety protocol is followed. The ladder rungs are not suitable for usage.

The walls showed some indications of deterioration of the paste, but generally appeared to be in sound condition. The underside of the top slab was viewed and appears sound. No structural concerns were noted.

6.5 Primary Structural Systems

6.5.1 Loadbearing Walls, Columns and Beams

During the inspection, MPE was unable to assess the superstructure components due to the cladding installed. The drawings provided by the City indicate the structure was built using YTONG Autoclaved Concrete Blocks. The drawings also indicate the structure originally had two windows on the west side. These appear to have been removed and possibly filled in. The configuration is durable. The subgrade concrete walls and base slab appear to be in “fair” condition, though the finishes are deteriorating.

6.5.2 Suspended Floors, Trusses, and Joists

The main floor slab appears to be in “Fair” condition from the top but the finish has worn off and is covered in insulation on the bottom, preventing a full assessment. Future renovations will need to include re-finishing the floor. MPE was unable to view the trusses during the inspection.

6.6 Secondary Structural Systems

6.6.1 Stairs, Ladders, Catwalks, Hatches, Rails

The mid-level walkway is not code compliant due to the lack of guardrails, kick plate, and proper access. The connections to the concrete walls are in very “Poor” condition. It is considered unsafe for use and requires complete replacement. The dry well ladder appears to be fit for use; however, the wet well ladder is subject to a corrosive environment and should not be used.

The dry well hatch is square. The hatch is not code compliant because it could fall through the opening. There are also no rails or a gate around the opening.

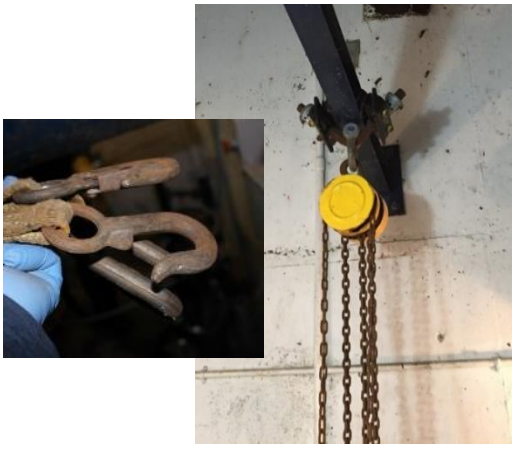
6.6.2 Interior Walls, Ceilings, Support Members, Equipment Pads

The plywood interior finishes are aged and should be replaced with the next renovation. Equipment pads appear to be in "Good" condition. Two mid-level cross beams (painted red), are show signs of corrosion. The beams were used to support the bearings of a historical extended pump shaft. The shaft has since been removed and consideration should be made for the removal of the beams.

6.6.3 Finishes

The paint on the floor surfaces has worn off on all levels. An epoxy coating on the floor would be ideal for durability, but will require additional prep work in the lower pump room due to the age of the concrete and the surface deterioration. Walls can be resurfaced with a latex or suitable acrylic-latex paint to improve aesthetics and protect the surfaces.

6.6.4 Monorails and Hoists



The lower level hoist is aging and corroding and the monorail is showing some signs of corrosion as well. The hooks used for this hoist are missing latches and are not code compliant. It is unable to deliver equipment to the exterior of the building. Future renovations should consider upgrading the hoist system and including a roof-access hatch for equipment removal.

MPE was unable to obtain a copy of the third party monorail and hoist certification.

6.7 Building Envelope

6.7.1 Exterior Siding, Roofing, Doors

The stucco siding has several holes that are primarily on the east and north sides of the building. The holes on the north side have been covered by a plate and bolt; however, the covering is imperfect and will not properly seal the envelope. The asphalt shingle roof is aging and in need of replacement.

6.7.2 Insulation, Vapour Barrier, Interior Liner

The insulation in the superstructure is installed with the vapour barrier on the wrong side. This configuration can be problematic because the vapour barrier is no longer on the inside "warm" face, which could lead to some condensation building behind the insulation. Operations staff have noted that excessive condensation occurs in the station during humid weather. Insulation installed against concrete surfaces should not pose a problem. Future renovations should install a suitable vapour barrier and interior liner to protect the insulation.

There is also a hole on the interior that penetrates the vapour barrier and the insulation, compromising the envelope.

6.7.3 Flashings, Soffits, Sealants, Weather-stripping

The door weather seal and threshold do not seal properly. The overall envelope is not weather tight.

6.8 Roofing

6.8.1 Roof Membrane, Insulation, Decking

The roofing is an asphalt shingle system, and was not able to be reviewed due to the snow cover. Typically, these roofs should last up to 30 years.

6.8.2 Skylights, Hatches, Penetrations

The roofing penetrations were not able to be reviewed at the time of the site visit.

6.8.3 Flashings, Trim, Gutters, Downspouts

The flashing and trim around the roof are damaged and in need of replacement.

6.9 Building Mechanical

6.9.1 Heating

The building includes a portable heater that is in is in "Fair" operational condition located in the building main level. It is recommended that a wall mount unit heater complete with a thermostat be installed in the building and dry well lower level to maintain a consistent temperature in the building and vault.

6.9.2 Interior Plumbing

The domestic plumbing consists of steel and PVC piping and includes a water meter and double check valve assembly. The plumbing system is used to supply hose bibs in the lift station. The plumbing system is in "Fair" condition.

Drain lines from the building are directed to a sump in the drywell lower level. A sump pump is used to discharge water from the sump to the wet well. The drainage system is in "Fair" condition and no operational concerns were noted.

6.9.3 Fire Suppression Systems

The building has no apparent fire suppression system. It is recommended that a handheld ABC fire extinguisher be installed by the building entrance.

6.9.4 Gas Distribution

There is no gas distribution system at the lift station.

6.10 Facility Assessment Cost Summary

Table 6.2 summarizes the cost estimates and recommended Action for each recommendation for the facility assessment.

TABLE 6.2: ST. CHARLES FACILITY IMPROVEMENT COST ESTIMATES

Item	Facility Section	Action	Cost
1	Site Conditions	Short Term	$ 1,200.00
2	Foundations	Mid Term	$ 150,000.00
3	Primary Structural Systems		
4	Secondary Structural Systems	Mid Term	$ 99,000.00
5	Building Envelope	Mid Term	$ 4,000.00
6	Roofing	Short Term	$ 8,500.00
7	Building Mechanical	Mid Term	$ 3,000.00
		Total:	**$ 265,700.00**

The capital costs for the recommended improvements have been ***estimated in 2019 dollars***. The cost estimate provided is an opinion of probable cost and is a function of many factors that can change with time and hence must not be relied upon as the actual cost. Construction equipment and methods that are commonly used in the industry are assumed for estimating purposes. The estimates have been provided to assist the City with budgetary planning purposes only and should not be used as actual quotes. The cost estimates are exclusive of taxes.

6.11 Conclusions & Recommendations

The major findings of the facility assessment of the St. Charles Lift Station are summarized as follows:

- There is possible ponding against the building during wet weather.
- The wet well access is located within the building. This is a possible H2S safety concern.
- The lower level walkway is not code compliant and unsafe for use.
- The hatches are not code compliant.
- The building envelope is compromised.

A detailed breakdown of the recommendations and associated costs can be found in **Appendix A**. The recommendations are summarized in Table 6.3:

TABLE 6.3: ST. CHARLES FACILITY RECOMMENDATIONS	
Component	**Recommendation**
Site Conditions	Fill low area to ensure grade slopes away from building
Foundations	Review options for isolating wet well access
Primary Structural Systems	Replace lower level platform
Secondary Structural Systems	Replace hoist and lifting sling / hooks
	Epoxy coat floors
	Repaint walls and ceiling
	Replace lower monorail
	Replace hatch with hinged, add railing and swing gate
	Install roof access hatch for pump removal
Building Envelope	Repair holes in exterior and interior
	Replace weatherstripping
Roofing	Replace roofing, flashing, and trim
Building Mechanical	Install Wall mount unit heater in vault and building c/w thermostat
	Install handheld fire extinguisher by building entrance

7.0 Mechanical Equipment Condition Assessment

7.1 Background

This section provides an assessment of the process mechanical equipment in terms of the condition of individual system components and code and regulation compliance. The assessment identifies existing infrastructure that will require replacement or maintenance. A condition rating and priority has been given to the equipment to identify priority of future upgrades. Recommendations and project time frames have been developed in order to assist the City in prioritizing future projects. The Condition Assessment Forms have been appended to this report.

The St. Charles Lift Station houses sewage pumping equipment and associated piping and valves located in the dry well lower level.

TABLE 7.1: ST. CHARLES LIFT STATION MECHANICAL OVERVIEW	
YEAR CONSTRUCTED	1993
PUMPING CAPACITY	20 L/sec
LOCATION	435 Sansome Ave
NUMBER OF PUMPS	Two (2)
PUMP HORSEPOWER	P-101: 10 HP, P-102: 10 HP
TYPE OF PUMPS	Dry Pit Solids Handling
PIPING MATERIAL	Carbon Steel

All process mechanical equipment in the lift station was installed during the major upgrades in 1993. Maintenance efforts have been carried out by the City of Winnipeg Operations and Maintenance staff including routine servicing, preventative maintenance, and building cleanup. In general, the equipment is in “Fair” operational condition. Operational staff noted that there are concerns with the pumps plugging constantly with rags, rocks and debris. The pumps run continuously for long periods after rainfall events.

7.2 Code Review

A review of the lift station equipment was undertaken to verify compliance with current ANSI and Hydraulic Institute design standards. Table 7.2 provides a summary of the code review.

TABLE 7.2: MECHANICAL CODE REVIEW			
YEAR CONSTRUCTED	1993		
LOCATION	435 Sansome Ave		
PUMPS			
TYPE	Dry Pit Solids Handling		
PUMP LOCATION	Dry Well		
SUCTION SOURCE	Wet Well - Direct Piped		
PIPING			
SUCTION/DISCHARGE DIAMETER	150 mm / 100 mm		
MATERIAL	Carbon Steel		
ITEM	**REQUIREMENT**	**CODE COMPLIANCE**	**CODE REFERENCE / NOTES**
SUCTION INTAKE SUBMERGENCE	250 mm	YES	*ANSI/HI 9.8-2012 Section 9.8.7*
SUCTION INTAKE FLOOR CLEARANCE	100 mm	YES	*ANSI/HI 9.8-2012 Section 9.8.3.2.3.2*
SUCTION INTAKE WALL CLEARANCE	75 mm	YES	*ANSI/HI 9.8-2012 Section 9.8.3.2.3.1*
SUCTION BELL	Required	YES	*ANSI/HI 9.6.6-2016 Section 9.6.6.3.6*
SUCTION PIPING VELOCITY	2.4 m/s	YES	*ANSI/HI 9.6.6-2016 Section 9.6.6.3.1*
SUCTION STRAIGHT PIPE LENGTHS	5	YES	*ANSI/HI 9.6.6-2016 Section 9.6.6.3.3*
PUMP VIBRATION	0.15 in/sec	NO	*ANSI/HI 9.6.4-2016 Section 9.6.4.2.5*
PUMP TEMPERATURE	160 F	YES	*ANSI/HI 9.6.5-2016 Section 9.6.5.2.6*
DISCHARGE PIPING VELOCITY	4.5 m/s	YES	*ANSI/HI 9.6.6-2016 Section 9.6.6.4.1*
VALVES	Isolation / check	YES	*ANSI/HI 9.6.6-2016 Section 9.6.6.4.3*

7.3 Pumps

The lift station houses two (2) dry pit solids handling pumps. P-101 and P-102 are identical Aurora 664 SF pumps. Each is equipped with a 10 HP, 575 VAC, 3 phase, 60 Hz electric motor. Both pumps are rated for 18.93 L/sec at a TDH of 9.6 m and operate at constant speed. P-101 and P-102 were installed in 1993 and are used regularly. Operational staff noted that there are concerns with the pumps plugging constantly with rags, rocks and debris. The pumps run continuously for long periods after rainfall events.

Overall the pumps are in “Fair” condition. Table 7.3 provides a summary of the condition of the pumps at the St. Charles Lift Station.

TABLE 7.3: ST. CHARLES LIFT STATION PUMP CONDITION ASSESSMENT						
PUMP	**DESCRIPTION**	**MAKE**	**MODEL**	**CONDITION**	**IMPORTANCE**	**ACTION**
P-101	10 HP DRY PIT SOLIDS HANDLING	AURORA	664 SF	FAIR	Important	Short Term
P-102	10 HP DRY PIT SOLIDS HANDLING	AURORA	664 SF	FAIR	Important	Short Term

7.3.1 Vibration and Temperature

MPE collected onsite pump vibration and temperature measurements when the pumps were in operation. Temperature measurements were recorded on the pump motor and volute using an infrared thermometer. Vibration readings were recorded in the x, y, and z axis on the pump motor and volute using a Digital Measurement Metrology Digital Vibration Meter. Table 7.4 provides a summary of the vibration and temperature readings at the St. Charles Lift Station.

TABLE 7.4: ST. CHARLES LIFT STATION PUMP VIBRATION AND TEMPERATURE

PUMP	VIBRATION (in/s)			TEMPERATURE (F)
	x	y	z	
P-101				
Motor	0.00	0.00	0.00	69
Volute	0.00	0.00	0.00	51
P-102				
Motor	0.15	0.31	0.11	65
Volute	0.00	0.00	0.00	51

The temperature readings were found to be within the required tolerances as set out in *ANSI/HI 9.6.5-2009 Rotodynamic Pumps – Guideline for Condition Monitoring*. Vibration readings for Pump 2 were found to be above the 0.15 in/s tolerance as set out in *ANSI/HI 9.6.4-2009 Rotodynamic Pumps for Vibration Measurements and Allowable Values.*

7.4 Valves

The valves were installed in 1993. The manually actuated gate valves are used for isolation of equipment for maintenance and are not regularly exercised. The check valves are critical to the operation of the lift station and are exercised regularly through operation. In general, valves are in "Fair" condition. Table 7.5 provides a summary of the condition of the valves at the St. Charles Lift Station.

TABLE 7.5: ST. CHARLES LIFT STATION VALVE CONDITION ASSESSMENT

VALVE	DESCRIPTION	SIZE	CONDITION	IMPORTANCE	ACTION
GAV-101A	Gate Valve	150 mm	FAIR	Intermediate	Mid Term
GAV-101B	Gate Valve	150 mm	FAIR	Intermediate	Mid Term
GAV-102A	Gate Valve	150 mm	FAIR	Intermediate	Mid Term
GAV-102B	Gate Valve	150 mm	FAIR	Intermediate	Mid Term
GAV-103	Gate Valve	150 mm	FAIR	Intermediate	Mid Term
GAV-104	Gate Valve	150 mm	FAIR	Intermediate	Mid Term
CHV-101	Swing Check Valve	150 mm	FAIR	Important	Mid Term
CHV-102	Swing Check Valve	150 mm	FAIR	Important	Mid Term
KGV-101	Knife Gate Valve	150 mm	FAIR	Intermediate	Mid Term

7.5 Piping & Fittings

The lift station includes carbon steel piping for conveyance. The pipe flanges are constructed of carbon steel and stainless steel bolts and nuts have been used. In general, the piping is in "Fair" condition. Table 7.6 provides a summary of the condition of the piping at the St. Charles Lift Station.

TABLE 7.6: ST. CHARLES LIFT STATION PIPING CONDITION ASSESSMENT

PIPING	MATERIAL	CONDITION	IMPORTANCE	ACTION
P-101 Suction Line	Carbon Steel	FAIR	Important	Mid Term
P-102 Suction Line	Carbon Steel	FAIR	Important	Mid Term
P-101 Discharge Line	Carbon Steel	FAIR	Important	Mid Term
P-102 Discharge Line	Carbon Steel	FAIR	Important	Mid Term
Discharge Header	Carbon Steel	FAIR	Important	Mid Term
Backflush Line	Carbon Steel	FAIR	Intermediate	Mid Term

7.5.1 Non-Destructive Testing

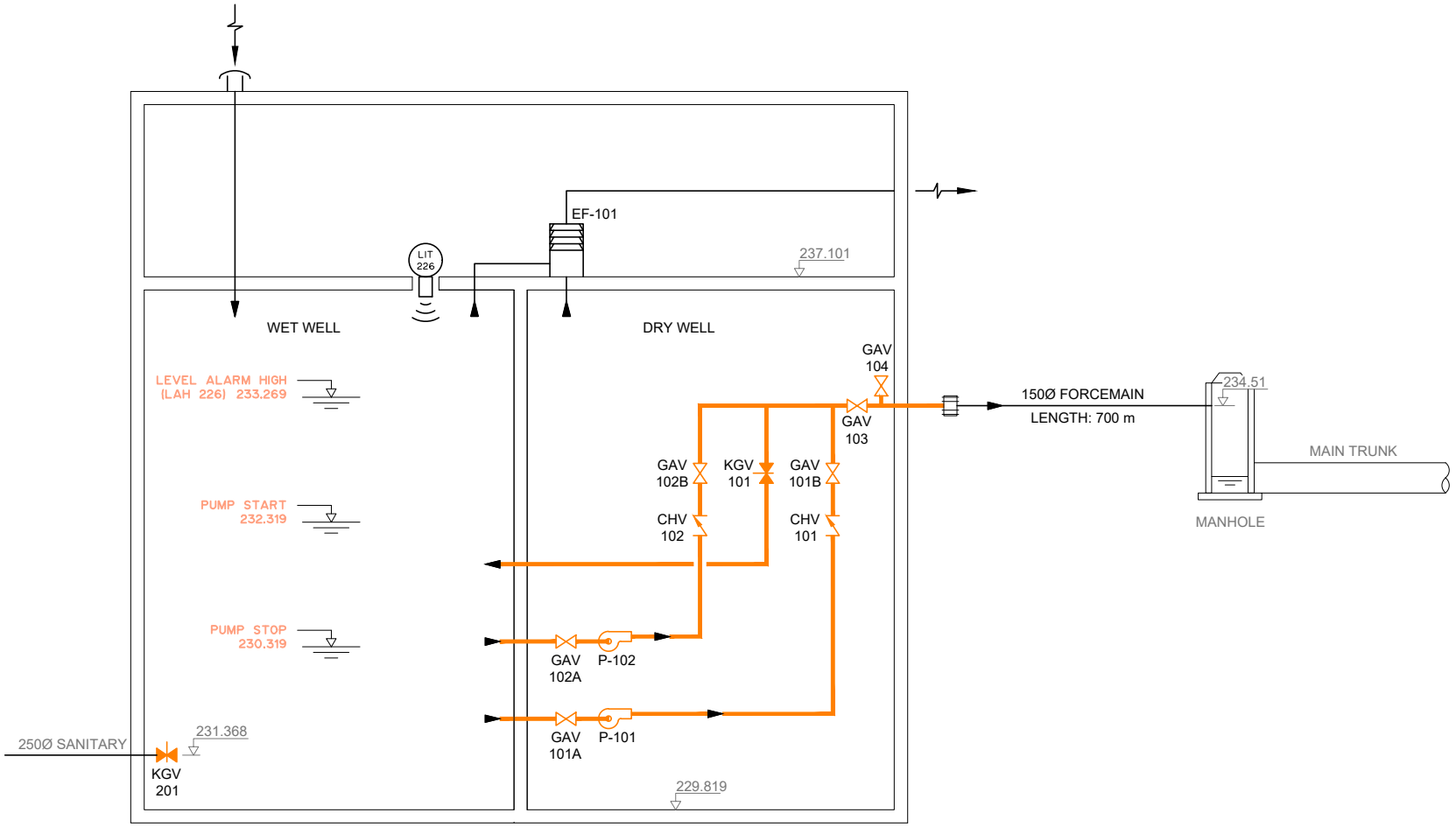
Non-destructive testing was not performed on the piping in the lift station.

7.5.2 Cathodic Protection

The lift station does not include cathodic protection and cathodic protection is not recommended for this station.

7.6 Summary of Condition Assessment

Figure 7.1 provides a graphical summary of the condition assessment of the mechanical components of the St. Charles Lift Station.



P-101
- DUTY POINT: 18.93 L/s @ 9.6 m
- 10 HP. 1200 RPM
- 575 VAC/3 PH/60 Hz

P-102
- DUTY POINT: 18.93 L/s @ 9.6 m
- 10 HP. 1200 RPM
- 575 VAC/3 PH/60 Hz

LEGEND
- POOR
- FAIR
- GOOD
- EXCELENT

Winnipeg

MPE Engineering Ltd.

LIFT STATION ASSESSMENTS 2018-2019

ST. CHARLES
CONDITION ASSESSMENT SUMMARY

SCALE: NTS	DATE: SEPT 2019	JOB: 8400-001-00	FIGURE: 7.1

7.7 Conclusions

The major findings for the Process Mechanical Assessment are summarized as follows:

- The mechanical equipment is generally in "Fair" condition and sufficient for its intended purpose.
- The pumping system is currently undersized to meet the peak wet weather flows.
- There are issues with the lift station pumps handling solids.
- The pumping system should be upgraded with new equipment.

7.8 Recommendations

7.8.1 Pump and Piping Replacement (0-5 years)

Due to the age and capacity of the pumping system, it is recommended that the complete replacement of the pumps, piping, and valves be completed within the next 5 years.

7.9 Improvement Cost Estimates

The capital costs for the recommended improvements are summarized in Table 7.7. These upgrades will provide long-term benefits to the sewage works system operations.

TABLE 7.7: MECHANICAL EQUIPMENT IMPROVEMENT COST ESTIMATES

ITEM	ACTION	DESCRIPTION	CAPITAL COST
1	Short Term	Pump and Piping Replacement	$205,800
TOTAL			**$205,800**

The capital costs for the recommended improvements have been ***estimated in 2019 dollars***. The cost estimate provided is an opinion of probable cost and is a function of many factors that can change with time and hence must not be relied upon as the actual cost. Construction equipment and methods that are commonly used in the industry are assumed for estimating purposes.

8.0 Electrical Equipment Condition Assessment

8.1 Background

This section provides an assessment of the electrical equipment in terms of the condition of individual system components and code and regulation compliance. The assessment identifies existing infrastructure that will require replacement or maintenance. A condition rating and priority has been given to the equipment to identify priority of future upgrades. Recommendations and project time frames have been developed in order to assist the City in prioritizing future projects. The Condition Assessment Forms have been appended to this report.

The St. Charles Lift Station houses electrical equipment such as pump motors, and full voltage starters.

TABLE 8.1: ST. CHARLES LIFT STATION ELECTRICAL OVERVIEW

YEAR CONSTRUCTED	
LOCATION	435 Sansome Ave
SERVICE	100 AMP
VOLTAGE	600 VAC
STANDBY GENERATOR SIZE	N/A
NUMBER OF PUMPS	Two (2)
PUMP HORSEPOWER	P-101: 10HP, P-102: 10HP

8.2 Code Review

As part of the condition assessment of the equipment and installation methods at the St. Charles Lift Station, MPE reviews equipment and installations to assess whether standards set forth in applicable codes and regulations are met. The Canadian Electrical Codes CSA C22.1-15 and NFPA 820 are of particular relevance for wastewater lift station electrical systems. According to the NFPA 820 Table 4.2 Row 17, a below grade or partially below grade wastewater pumping station dry well that is ventilated with fewer than 6 air changes per hour is to be classified as a Zone 2 (or Class 1 Division 2) space. The dry well and above grade building are connected through the dry well access and are therefore considered a single air space. This air space is not ventilated continuously to the minimum standards to achieve an unclassified rating. Currently, the electrical equipment within the station is not rated for use in a Zone 2 space, therefore it is recommended that the ventilation system be upgraded to provide the necessary air changes to achieve an unclassified rating. Row 1 of Table 9.1.1.4 in the NFPA 820 requires a minimum of 12 air changes per hour to classify a wet well as a Zone 2 (or Class 1 Division 2) space. This lift station is unable to meet the required number of air changes per hour and is therefore classified as a Zone 1 space. Along with ventilation requirements, the access hatch to the wet well would require “Physical Separation” as per NFPA 820 definitions 3.3.43 and A3.3.43.

CSA C282 provides the standard for emergency electrical power supplies for buildings where emergency electrical supplies are required by the National Building Code of Canada, or for essential electrical systems such as health care facilities. Emergency power generation is not required at this facility under this definition and, therefore, it is not required that this installation adhere to the requirements of the CSA 282 standard. Table 8.2 provides a summary of the code review.

TABLE 8.2: ELECTRICAL CODE REVIEW			
YEAR CONSTRUCTED			
LOCATION	435 Sansome Ave		
WET WELL			
HAZARDOUS LOCATION CLASSIFICATION	Zone 1		
CORROSIVE ENVIRONMENT CATEGORY	Category 1		
DRY WELL			
HAZARDOUS LOCATION CLASSIFICATION	Zone 2		
CORROSIVE ENVIRONMENT CATEGORY	Category 2		
ITEM	**REQUIREMENT**	**CODE COMPLIANCE**	**CODE REFERENCE / NOTES**
EXPLOSION PROOF INSTALLATION	Required	NO	*CSA 22.1-15 CEC Section 18, NFPA 820*
AIR CHANGES FOR UNCLASSIFED RATING	6 air changes in dry well	NO	*NFPA 820*
AIR CHANGES FOR ZONE 2 RATING	12 air changes in wet well	NO	*NFPA 820*
CORROSIVE ENVIRONMENT WIRING	Required	NO	*CSA 22.1-15 CEC Section 22*
MINIMUM CLEARANCE	1 m Required	YES	*CSA 22.1-15 CEC Section 2-308*
MOTOR OVERCURRENT PROTECTION	Motor Breakers Adequate	YES	*CSA 22.1-15 CEC Section 28-200*
FEEDER OVERCURRENT PROTECTION	Service Breaker Adequate	YES	*CSA 22.1-15 CEC Section 28-204*
EMERGENCY POWER SUPPLY	Sufficient Capacity	N/A	*CSA 22.1-15 CEC Section 46-202*
EMERGENCY POWER SUPPLY	Onsite Fuel Storage	N/A	*CSA C282 (Not Required)*

8.3 Electrical Service Entrance Equipment

The electrical service is 600 VAC, 3 Phase, 100 Amp, 60 Hz service. The service is fed overhead via a pole mount transformer. The main service and associated equipment is located on the main level of the Lift Station. St. Charles lift station's main service is constructed as a "stick build" through the use of disconnects, splitters, and separate starters. Service entrance equipment appears to be in "Fair" condition due to the corrosion taking place at termination points. Current City guidelines prefer the use of a Motor Control Centre (MCC) and breakers. Currently there are no provisions at the St. Charles Lift Station for a temporary generator connection in the event of power outages. Table 8.3 provides a summary of the condition of the service entrance equipment at the St. Charles Lift Station.

TABLE 8.3: ST. CHARLES LIFT STATION SERVICE ENTRANCE EQUIPMENT CONDITION ASSESSMENT

DESCRIPTION	RATED VOLTAGE	CONDITION	IMPORTANCE	ACTION
Main Disconnect	600 VAC	Fair	Important	Short Term
Splitter and Meter	600 VAC	Fair	Important	Short Term

8.4 Cable and Conduit

The wiring style in St. Charles Lift Station is primarily run using RPVC with minor amounts of threaded rigid, and Teck within the lift station. RPVC does not meet Zone 1 requirements.

8.5 Motors

The lift station is equipped with two (2) pumps. Both P-101 and P-102 are equipped with a 10HP, 575VAC 3 phase U.S. Electric motor. The Vent motor is a 115/208-230VAC 1/3HP electric motor. The pump motors for P-101 and P-102 appear to have been previously painted, assuming in an attempt to reduce corrosion effecting the motors. Surface corrosion is still evident. This is likely a result of inadequate ventilation to clear the corrosive gases present in this station. For that reason, the life expectancy of these motors has been substantially reduced. P-101, and P-102 motors are in "Poor" condition. The vent motor appears to be in "Good" condition. Considering the age of the motors and the harmful atmosphere they have endured throughout the years, it is recommended that motors for P-101 and P-102 be replaced once ventilation and wet well access concerns have been addressed. Table 8.4 provides a summary of the condition of the motors at the St. Charles Lift Station.

TABLE 8.4: ST. CHARLES LIFT STATION MOTOR CONDITION ASSESSMENT

DESCRIPTION	HORSEPOWER	CONDITION	IMPORTANCE	ACTION
P-101 Motor	10HP	Poor	Important	Short Term
P-102 Motor	10HP	Poor	Important	Short Term
Vent Motor	1/3HP	Good	Intermediate	Mid Term

8.5.1 Motor Circuit Analysis/ HIPOT Testing

A motor circuit analysis was not conducted.

8.6 Full Voltage Starters

Each pump is equipped with a Full Voltage Non Reversing (FVNR) starter. The FVNR enclosures appear to be in "Good" condition, although internal corrosion is evident on wiring at the termination points leading to potential failure making the overall state of the FVNR's "Fair". Table 8.5 provides a summary of the condition of the starters at the St. Charles Lift Station.

TABLE 8.5: ST. CHARLES LIFT STATION MOTOR STARTER CONDITION ASSESSMENT

DESCRIPTION	RATED VOLTAGE	CONDITION	IMPORTANCE	ACTION
P-101 FVNR	600 VAC	Fair	Important	Short Term
P-102 FVNR	600 VAC	Fair	Important	Short Term

8.7 Transformers, Panelboards, and Distribution Equipment

Distribution Equipment is fed via a wall mounted splitter. Distribution equipment appears to be in "Good" condition. The main lighting panel is fed from a 600VAC:120/240VAC step down transformer. The transformer appears to be in "Good" condition. The lighting panel is also in "Good" condition. While distribution enclosures all appear in "Good" condition, internal corrosion is evident on wiring at the termination points making the overall condition of the equipment "Fair". Table 8.6 provides a summary of the condition of the transformers, panelboard, and distribution equipment at St. Charles Lift Station.

TABLE 8.6: ST. CHARLES LIFT STATION TRANSFORMERS, PANELBOARDS, AND DISTRIBUTION EQUIPMENT CONDITION ASSESSMENT				
DESCRIPTION	**RATED VOLTAGE**	**CONDITION**	**IMPORTANCE**	**ACTION**
Main Lighting Panel	120/208VAC	Fair	Intermediate	Short Term
Dry Type Transformer	600:120/208 VAC	Fair	Intermediate	Short Term
Building Envelope Lighting	120VAC	Fair	Intermediate	Short Term
Emergency Lighting	N/A	N/A	Important	Short Term

8.7.1 Lighting

Lighting at the St. Charles Lift Station is outdated and does not comply with the recommended fixtures of LED or F32T8 set forth in the City of Winnipeg Design Guide. Fixtures in use are original incandescent style fixtures with LED replacements luminaires. Exterior lighting above man doors would be recommended.

8.7.2 Emergency Lighting

No emergency lighting was present in the St. Charles Lift Station. Winnipeg Design Guide calls for emergency lighting in all facilities. Addition of adequate emergency lighting to each level of the lift station as required is recommended.

8.8 Standby Power Generators and Engines

There is currently no connection means for standby power. It would be recommended to install a manual transfer switch for City Staff to connect their temporary generator to in the event of a power outage.

8.9 Conclusions

The major findings for the electrical equipment at the St. Charles Lift Station are summarized as follows:

- In general, the electrical equipment at this site is in “Poor” condition.
- The dry well requires a ventilation upgrade along with the wet well hatch needing to be permanently sealed off and relocated in order for the existing electrical equipment to meet the Canadian Electrical Code.

8.10 Recommendations

8.10.1 Project 1: Electrical Upgrade (0-5 years)

Although enclosures appear in “Good” condition, the electrical system and equipment have endured a corrosive atmosphere for a prolonged period. For this reason, the electrical system is in “Poor” condition. A full electrical upgrade is recommended. Any upgrades should take into consideration the lack of redundancy at the St. Charles Lift Station by planning to maintain operation during upgrades and construction. The upgrade should address City concerns on motor and pump sizing and capacity concerns as both pumps continue to run well after storms in order to keep up. Prior to any electrical upgrades, it is recommended to solve all heating, ventilation and wet well hatch access concerns. This will prevent any new electrical equipment from having a shortened life expectancy due to moisture and corrosive atmospheres.

8.11 Improvement Cost Estimates

The capital costs for the recommended improvements have been estimated and are summarized in Table 8.7. These upgrades will provide long-term benefits to waterworks system operations. The cost estimates include contingency and engineering but do not include taxes.

TABLE 8.7: ELECTRICAL EQUIPMENT IMPROVEMENT COST ESTIMATES

ITEM	ACTION	DESCRIPTION	CAPITAL COST
1	Short-Term	Main Service Upgrade	$30,000
2	Short-Term	Replace Starters for P-101, and P-102	$4,000
3	Short-Term	Motors	$1,000
		Total:	**$35,000**

The capital costs for the recommended improvements have been ***estimated in 2019 dollars***. The cost estimate provided is an opinion of probable cost and is a function of many factors that can change with time and hence must not be relied upon as the actual cost. Construction equipment and methods that are commonly used in the industry are assumed for estimating purposes. Refer to Appendix E for the complete details of the capital cost estimate.

9.0 Controls & Instrumentation Conditions Assessment

9.1 Background

This section provides an assessment of the controls and instrumentation equipment in terms of the condition of individual system components and code and regulation compliance. The assessment identifies existing infrastructure that will require replacement or maintenance. A condition rating and priority has been given to the equipment, identifying future upgrades. Recommendations and project time frames are presented to assist the City in prioritizing future projects. The Condition Assessment Forms have been appended to this report.

The St. Charles Lift Station control system consists of Schneider TeleSAFE Micro 16, and an Ultrasonic Level Transmitter with a Float Level Switch.

TABLE 9.1: ST. CHARLES LIFT STATION CONTROLS & INSTRUMENTATION OVERVIEW	
YEAR CONSTRUCTED	
LOCATION	435 Sansome Ave
LAST AUTOMATION UPDATE	2013
CONTROLLER	TeleSAFE Micro 16
PROGRAMMING SOFTWARE	
COMMUNICATION TYPE	Public Service Telephone Network (PSTN)
SCADA SOFTWARE	

9.2 Control Systems

A TeleSAFE Micro 16 monitors the lift station. The Remote Telemetry Unit (RTU) is used for monitoring and reporting only. Monitoring is done using a Public Switched Telephone Network (PSTN), which has become obsolete within City of Winnipeg Lift Stations. Current lift station upgrades utilize MTS 4G cellular communication. Pump control is achieved using an Ultrasonic Level Transmitter. Currently, the station does not have control redundancy. This has been added to prior Lift Station upgrades and would be a recommended upgrade at the St. Charles Lift Station. Field devices include one Ultrasonic Level Transmitter, and a Float Level Switch.

9.2.1 Manual Control

Manual controls are located on the main level of the lift station. Hand-Off-Auto switches are located on the front panel of each motor starter. Manual control is achieved by turning the local switch to the Hand position, the motor becomes locally controlled by operations. Manual controls are functional and in “Good” condition.

9.2.2 Programmable Logic Controllers (PLC) and Remote Telemetry Units (RTU)

The RTU controller in use at this lift station is a TeleSAFE micro 16. The current communication system does not match the new City of Winnipeg Standard for control panel requirements. It is recommended to upgrade communication equipment to match current upgrades at other City lift stations. Along with the control panel upgrades, consideration should be given to the use of a PLC or RTU controller, which allows for custom lift station operation that can be programmed by any local integrator. This will open up the ability to adjust set points and operate pumps remotely if used for pump control. Future upgrades should evaluate if these functions are desired

and options for securing communications should be explored at that time. The condition of the RTU controller is in "Good" condition. No physical degradation of the controller was noted.

9.2.3 Human Machine Interface (HMI)

St. Charles Lift Station is not equipped with an HMI.

9.2.4 Control Panel

The control panel is located on the main level of the lift station and contains the TeleSAFE Micro 16 as well as all of the equipment required for reporting to the SCADA system at Mcphillips Control Centre. The general condition of this panel and the equipment it contains is "Good". While wiring is run with cable management devices such as Panduit, it has not been maintained within the Panduit. Terminations are secure, and cabling appears to be in "Good" condition. Wire labelling is applied to both ends of the wire, and device tagging has been used.

9.2.5 SCADA

The RTU controller is integrated into the central SCADA application at the McPhillips Control Centre. Data collected by the RTU is transmitted via the PSTN line.

9.2.6 Communication Hardware

Communications to the St. Charles Lift Station are accomplished using PSTN communication. The station reports alarms to the McPhillips Control Centre SCADA application via the communication link.

Table 9.2 provides a summary of the condition of the control equipment at St. Charles Lift Station.

TABLE 9.2: ST. CHARLES LIFT STATION CONTROL PANEL CONDITION ASSESSMENT

CONTROL PANEL	DESCRIPTION	CONDITION	IMPORTANCE	ACTION
Control Panel	Pump Controls and Monitoring	Good	Important	N/A
Communications Equipment	PSTN	Good	Importnant	Short Term

9.3 Instrumentation

Instrumentation at the St. Charles Lift Station includes one Ultrasonic Level Transmitter, Float Level Switch and a Flowmeter. In general, the instrumentation is in "Good" condition. Table 9.3 provides a summary of the condition of the instrumentation at the St. Charles Lift Station.

TABLE 9.3: ST. CHARLES LIFT STATION INSTRUMENTATION CONDITION ASSESSMENT

INSTRUMENTATION	DESCRIPTION	CONDITION	IMPORTANCE	ACTION
LIT-101	Level Transmitter	Good	Important	Mid Term
LSHH-101	Building Flood Detector	Good	Low	Mid Term
FIT-101	Flow Transmitter	Poor	Important	Short Term

9.3.1 Process Control

9.3.1.1 *Pumping*

The primary process control device used at the St. Charles Lift Station is an Ultrasonic Level Transmitter. The condition of the level transmitter appears to be in "Good" condition. There is currently no redundancy in case of instrument failure. Pumps start and stop based on the wet well level determined by these devices. It is recommended that a redundant level transmitter be installed to mitigate the risk of environmental damage and damage to property resulting from a flood situation.

9.3.2 Gas Monitoring

St. Charles Lift Station does not have continuous gas monitoring. Within the lift station, City Staff utilize personal gas detection monitors.

9.3.3 Process Monitoring

The wet well level is monitored continuously using the Ultrasonic level transmitter. The wet well level is transmitted back to the central SCADA application where they are monitored by operations staff. Issues arising from out of normal values are highlighted with alarms and operations staff are notified to take action. The lift station is equipped with a flowmeter, which has been out of service since September 2017. It is recommended that the flowmeter be incorporated into control system upgrades to allow for continuous flow monitoring.

9.3.4 Building Monitoring

Building alarms, including flood detection are transmitted back to the central SCADA application. Operators are notified if an alarm condition exists and are able to take action to correct the alarm. No heat detector or low building temperature sensor is installed at this station; it is recommended that both of these devices be installed.

9.4 Pump Control Strategy & Reliability Review

9.4.1 Sanitary

The pump control strategy employed at this station is a basic level based pump control system. Each pump has a start level and a shut down level that are off set such that the additional pump is enabled as the level becomes higher. Multiple pumps increase system reliability; however, this system operates with only two pumps.

9.5 Conclusions

The major findings for the controls and instrumentation at St. Charles Lift Station are summarized as follows:

- The automation platform in use at this lift station does not meet current City Lift Station upgrades, it also does not provide remote set point or remote pump control capability.
- No redundant level detector presents an environmental risk if the primary level detector fails.
- No operating continuous flow monitoring.
- No heat detectors or low building temperature sensors are installed. A Heat detector would provide advanced warning of fire at this lift station, along with low building temperature sensors alleviating the risk of freezing throughout the winter months.

9.6 Recommendations

9.6.1 Project 1: Controls Upgrade (0-5 years)

The St. Charles Lift Station does not conform to current lift station upgrades throughout the City. Within the control

panel upgrades the following additions would be recommended:

- Utilize the MTS 4G Communication network.
- Upgrade to a 24V UPS.
- Installation of a redundant level transmitter to protect the lift station against instrument failure and potential overflows.
- Incorporate the existing flow transmitter for continuous flow monitoring of the station allowing the City to assess pump performance along with providing the City with more data on flow outputs from the lift station for future planning.
- Heat detector and a low building temperature sensor to be installed alerting operators of fire or freezing conditions at the lift station.

9.7 Improvement Cost Estimates

The capital costs for the recommended improvements have been estimated and are summarized in Table 9.4. These upgrades will provide long term benefits to waterworks system operations. The cost estimates include contingency and engineering but do not include taxes.

TABLE 9.4: CONTROLS & INSTRUMENTATION IMPROVEMENT COST ESTIMATES

ITEM	ACTION	DESCRIPTION	CAPITAL COST
1	Short-Term	Controls Upgrade	$43,500
		Total:	**$43,500**

The capital costs for the recommended improvements have been ***estimated in 2019 dollars***. The cost estimate provided is an opinion of probable cost and is a function of many factors that can change with time and hence must not be relied upon as the actual cost. Construction equipment and methods that are commonly used in the industry are assumed for estimating purposes. Refer to Appendix C for the complete details of the capital cost estimate.

10.0 Dry & Wet Well Ventilation Review

10.1 Background

The St. Charles Lift Station ventilation system includes one exhaust fan located in the main floor of the building. The ventilation system is used intermittently when the building is occupied. The exhaust fan pulls air from the dry well and wet well through separate pipes to create a negative pressure in the spaces. Fresh air is then brought into the wet well by gravity through a pipe that penetrates through the roof of the building that connects to the wet well. Fresh air is brought into the building and dry well through a wall louvre. No major ventilation upgrades have been carried out at the lift station since its original construction. In general, the equipment is showing signs of aging, and is in "Fair" condition. The Condition Assessment Forms have been appended to this report.

TABLE 10.1: ST. CHARLES LIFT STATION VENTILATION OVERVIEW	
YEAR CONSTRUCTED	1993
ODOUR CONTROL	No
DRY WELL	
VENTILATION TYPE	Intermittent
VENTILATION RATE	921.6 m^3/hr
WET WELL	
VENTILATION TYPE	Intermittent
VENTILATION RATE	921.6 m^3/hr

10.2 Ventilation Requirement Review

Table 10.2 provides a summary of the ventilation system at the St. Charles Lift Station.

TABLE 10.2: ST. CHARLES LIFT STATION VENTILATION REQUIREMENTS

VENTILATED AREA	VOLUME (m^3)	VENTILATION FREQUENCY	REQUIRED AIR CHANGES PER HOUR	REQUIRED VENTILATION RATE (m^3/hr)	CURRENT VENTILATION RATE (m^3/hr)	VENTILATION TYPE
Dry Well	76	Intermittent	30	2,288	922	Exhaust Fan
Wet Well	22	Intermittent	30	650	922	Exhaust Fan

As illustrated in Table 10.2, the current dry well ventilation system is undersized to meet NFPA 820 and Ten States ventilation requirements of 30 air changes per hour when used intermittently. The wet well ventilation system is adequately sized to meet the ventilation requirements of 30 air changes per hour when used intermittently, however, the wet well and dry well ventilation systems currently utilize the same exhaust fan.

10.3 Ventilation Equipment

10.3.1 Fans, Blowers, & Blower Heaters

The exhaust fan was installed in 1993. MPE tested the airflow from the dry well exhaust pipe using a portable anemometer and found that the air flow provided by the unit matched the manufacturer's published data. In general, the exhaust fan is in "Fair" condition. Table 10.3 provides a summary of the condition of the fan at the St. Charles Lift Station.

TABLE 10.3: ST. CHARLES LIFT STATION FAN CONDITION ASSESSMENT				
EQUIPMENT	**DESCRIPTION**	**CONDITION**	**IMPORTANCE**	**ACTION**
EF-101	1/3 HP Centrifugal Exhaust Fan	FAIR	Important	Mid Term

10.3.2 Intake and Exhaust Louvres and Dampers

The lift station includes intake and exhaust louvres. The louvres are in "Fair" operating condition.

10.3.3 Ventilation System Balancing

The ventilation system includes ducting for supply and exhaust in the wet well and dry well ventilation system. No concerns were noted with pressurization in the wet well or dry well.

10.4 Odour Control System

The lift station is not fitted with an odour control system.

10.5 Conclusion

The major findings for the Ventilation System Assessment are summarized as follows:

- The wet well and dry well ventilation systems are currently interconnected and utilize the same exhaust fan.
- The dry well intermittent ventilation system is undersized for the dry well fresh air requirements.
- The wet well intermittent ventilation system is adequately sized for the wet well fresh air requirements.

10.6 Recommendations

10.6.1 Upgrade Dry Well Ventilation System (0-5 years)

In order to provide a ventilation system that meets the required air changes per hour and reduces building corrosion and condensation, it is recommended that the existing ventilation system be upgraded to increase the capacity. The upgrades would include the installation of a blower heater that would connect to the existing ducting entering the dry vault and building to provide heated fresh air to the spaces to code requirements.

10.6.2 Upgrade Wet Well Ventilation System (0-5 years)

The existing exhaust fan should be disconnected and isolated from the dry well and could be utilized as the wet well intermittent ventilation system prior to entry into the wet well. It is recommended that the existing asbestos piping be removed and replaced.

10.7 Improvement Cost Estimates

The capital costs for the recommended improvements are summarized in Table 10.4. These upgrades will provide long-term benefits to the sewage works system operations. The cost estimates include contingency and engineering but do not include taxes.

TABLE 10.4: VENTILATION SYSTEM IMPROVEMENT COST ESTIMATES			
ITEM	**ACTION**	**DESCRIPTION**	**CAPITAL COST**
1	Short Term	Dry Well Ventilation Upgrades	$38,000
2	Short Term	Wet Well Ventilation Upgrades	$6,000
		TOTAL:	**$44,000**

The capital costs for the recommended improvements have been ***estimated in 2019 dollars***. The cost estimate provided is an opinion of probable cost and is a function of many factors that can change with time and hence must not be relied upon as the actual cost. Construction equipment and methods that are commonly used in the industry are assumed for estimating purposes.

11.0 Recommendations

11.1 Recommended Projects

A list of recommended improvements has been prepared. For each recommended item, an "Action" was assigned based on an established methodology indicating the time period when the improvement should be completed.

Through the development of recommendations relative to system improvements or upgrades, projects were identified as either "Maintenance", "Capital", or "Study" projects. The differentiation between "Maintenance" and "Capital" projects was established based on our understanding of the scope of the project, project cost, and the assumed ability of the City to perform the work required utilizing in-house resources. Recommended improvements for the sewage lift station are presented in Table 11.1.

TABLE 11.1: SUMMARY OF RECOMMENDED IMPROVEMENTS - ST. CHARLES LIFT STATION

Item	Project Type	Action	Cost
Facility Condition Assessment			
Site Conditions	Maintenance	Short Term	$1,200
Foundations	Capital	Mid Term	$150,000
Primary Structural Systems			$0
Secondary Structural Systems	Capital	Mid Term	$99,000
Building Envelope	Maintenance	Mid Term	$4,000
Roofing	Capital	Short Term	$8,500
Building Mechanical	Capital	Mid Term	$3,000
Subtotal:			**$265,700**
Mechanical Equipment Condition Assessment			
Pump Replacements	Capital	Short Term	$126,000
Valve Replacements	Capital	Short Term	$44,800
Pipe Replacements	Capital	Short Term	$35,000
Subtotal:			**$205,800**
Electrical Equipment Condition Assessment			
Main Service	Capital	Short Term	$30,000
Starters for P-101 & 102	Capital	Short Term	$4,000
Motors	Capital	Short Term	$1,000
Subtotal:			**$35,000**
Controls & Instrumentation Condition Assessment			
Control Panel	Capital	Mid Term	$40,000
UPS	Capital	Mid Term	$2,000
Milltronics Multiranger 100	Maintenance	Mid Term	$1,500
Subtotal:			**$43,500**
Dry & Wet Well Ventilation Review			
Ventilation System Upgrades	Capital	Short Term	$6,000
Dry Well Ventilation System Replacement	Capital	Short Term	$38,000
Subtotal:			**$44,000**
Total			
Total Estimated Cost - All Recommended Improvements:			**$594,000**

All recommendations were given an associated cost to implement. Cost estimates provided were based on engineering judgment for the component replacement value, and do not include ancillary costs associated with replacing a component. The cost estimates are intended to be used as a measure of comparing the lift stations, and

are not intended to be used for budgetary numbers. Actual replacement costs will require further investigation.

11.2 Code Compliance & Safety Concerns

A list of the code compliance and safety concerns for the sewage lift station are presented in Table 11.2.

TABLE 11.2: CODE COMPLIANCE & SAFETY CONCERNS - ST. CHARLES LIFT STATION

Item Description	Type
Site Conditions	
Foundations	
Wet well access within the building causes H_2S concerns.	Safety
Wet well is clasified as a confined space.	Safety
Primary Structural Systems	
Secondary Structural Systems	
Lower level walkway supports are deteriorating.	Safety
Lower level walkway is missing proper access, rails, kick plates, etc.	Code Compliance
Hatch lids are subjuect to falling through openings.	Code Compliance
Hatch openings do not include guard rails and gates.	Code Compliance
Building Envelope	
Roofing	
Building Mechanical	
There is no current fire suppression system.	Code Compliance
Building Ventilation	
Asbestos ventilation piping used.	Safety

Appendix A

Facility Condition Assessment Forms

Project No.: 8400-001-00
Tag: **STR_Site_Conditions**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

FACILITY CONDITION ASSESSMENT
SITE CONDITIONS

Assessor: Mark Baker
Date Assesed: 18-Apr-19

SECTION	ITEM	DATA		ASSESSMENT SCORES				AGE		
		Site Conditions: - Access to site, site grading, landscaping, perimeter fencing		Current Physical Condition	Fitness For Purpose		Safety	Year Installed	Expected Service Life	Remaining Service Life
Tag: STR_Site_Conditions	GENERAL	CODE COMPLIANCE ISSUES: SAFETY ISSUES:		3.0	2.8		3.0	1960	30	0
				Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)				6
	Current Physical Condition	**Site Access Road & Parking Lot:** *Issues for Discussion:* - Condition of surface -potholes, mud, etc - Proper bollards in place to protect infrastructure	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.4	*NOTES & COMMENTS:* *- No perimeter fence.* *- Site drainage not evaluated due to winter conditions* *- Ponding of water next to the building was noted on google image*				
		Site Grading & Landscaping: *Issues for Discussion:* - Ponding water on site - Ground sloped away from the building - Condition of vegetation on site - Trees overhanging powerlines or building - Trees blocking sight lines for access / exit	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.3					
		Fencing & Signage: *Issues for Discussion:* - Signage in place / visible - Fence and gate condition - *Warning signage appropriate*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.3					
	Fitness for Purpose	**Site Access Road & Parking Lot:** *Issues for Discussion:* - Sight lines entering and exiting the site - Sufficient parking space - Emergency vehicle accessibility	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	2	0.4	*RECOMMENDATIONS:* Fill low area to ensure grade slopes away from building	*COST ESTIMATE* $ 1,200.00			
		Site Grading & Landscaping: *Issues for Discussion:* - Suitibility of landscaping for the community - Grading sufficient to drain site	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	4	0.2					
		Fencing & Signage: *Issues for Discussion:* - Signage reflect important information, emergency # - Fencing and gate appropriate or needed for security	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.4					
	Safety	**Public and Operator Safety:** *Issues for Discussion:* - Historical safety incidents, or potential conditions - Evacuation of personnel (davit, gear, hatch locations)	Rating 1: No Public Safety issues Rating 3: No record of incidents,possible concerns Rating 5: Historic incidents or probable safety risks	3	1					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **STR_Foundations**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

FACILITY CONDITION ASSESSMENT FORM
FOUNDATION

Assessor: Mark Baker
Date Assesed: 18-Apr-19

SECTION	ITEM	DATA		ASSESSMENT SCORES				AGE		
		Foundations: - Foundation Slab, Below Grade Walls, Below Grade Columns and Beams		Current Physical Condition	Fitness For Purpose		Safety	Year Installed	Expected Service Life	Remaining Service Life
Tag: STR_Foundations	GENERAL	CODE COMPLIANCE ISSUES: - The wet well is accessed within the superstructure. - The internal access to the wet well causes H_2S concerns. SAFETY ISSUES:		3.0	3.0		3.0	1960	50	0
				Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)				3
	Current Physical Condition	**Base Slab:** *Issues for Discussion:* - Cracking, spalling, moisture infiltration - Evidence of settlements - Sump and Pump - Groundwater seepage deterioration - Effluorescence, salts from groundwater	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.3	*NOTES & COMMENTS:* *- Base slab shows surface deterioration. Structurally sound* *- Walls in good condition* *- Moisture on base slab due to pump leakage* *- Space is tight but functional* *- no apparent groundwater seepage* *- Wet well concrete structure shows minor surface deterioration. Structure remains sound.* *- Wetwell access inside building is not ideal. Numerous Code compliance issues.* *- Wet well classified as confined space* *- Wet well access inside building provides possible H2S*			
		Below Grade Exterior Walls, Columns and Beams: *Issues for Discussion:* - Cracking, spalling, moisture infiltration - Evidence of movement - Seepage through wet well wall	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.3					
		Wet Wells: *Issues for Discussion:* - Cracking, spalling, corrosion - Degredation at base of columns - Damage from equipment operation / removal	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.4					
	Fitness for Purpose	**Base Slab:** *Issues for Discussion:* - Sufficient space for equipement - Floor sloped sufficient to drain	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.3	*RECOMMENDATIONS:* Demo building, build larger pumphouse over existing vault with separate WW access	*COST ESTIMATE* $ 150,000.00			
		Below Grade Exterior Walls, Columns and Beams: *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.4					
		Wet Wells: *Issues for Discussion:* - Interference with function or equipment removal	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.3					
	Safety	**Public and Operator Safety:** *Issues for Discussion:* *- Potential safety hazards* - Evacuation of personnel (davit, gear, hatch locations)	Rating 1: No Public Safety issues Rating 3: No record of incidents,possible concerns Rating 5: Historic incidents or probable safety risks	3	1					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **STR_Primary_Str_Systems**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

FACILITY CONDITION ASSESSMENT FORM
PRIMARY STRUCTURAL SYSTEMS

Assessor: Mark Baker
Date Assesed: 18-Apr-19

SECTION	ITEM	DATA		ASSESSMENT SCORES: Current Physical Condition	Fitness For Purpose		Safety	AGE: Year Installed	Expected Service Life	Remaining Service Life
		Primary Structural Components: - Loadbearing walls, Columns, Beams, Trusses, Joists, Suspended floors								
Tag: STR_Primary_Str_Systems	GENERAL	CODE COMPLIANCE ISSUES: SAFETY ISSUES:		3.4	3.0		3.0	1960	50	0
				Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)				3
	Current Physical Condition	**Loadbearing walls, columns, beams:** *Issues for Discussion:* - Deterioration of concrete - Corrosion of steel (beams, column base, anchors...)	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	4	0.4	*NOTES & COMMENTS:* *- Unable to assess the building components. Drawings suggest the superstructure was was constructed using Autoclaved Concrete Blocks (YTong). Pre 1975 may contain low level natrual Uranium - possible radon emissions - not a known health hazard.* *- Drawings suggest that the structure originally had two windows.* *- Unable to view trusses.* *- Underside of main floor covered with insulation. Appears in fair cond.* *- Steel members are susceptible to corrosion.*			
		Trusses and Joists: *Issues for Discussion:* - Corrosion	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.3					
		Suspended Floors: *Issues for Discussion:*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.3					
	Fitness for Purpose	**Loadbearing walls, columns, beams:** *Issues for Discussion:* - Suitable access to equipment, levels - Compliance with Codes and Standards	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.4	*RECOMMENDATIONS:*		*COST ESTIMATE*		
		Trusses and Joists: *Issues for Discussion:* - Clearance	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.3					
		Suspended Floors: *Issues for Discussion:* - Sufficient Space for layout	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.3					
	Safety	**Public and Operator Safety:** *Issues for Discussion:* *- Potential safety hazards* - Evacuation of personnel (davit, gear, hatch locations)	Rating 1: No Public Safety issues Rating 3: No record of incidents,possible concerns Rating 5: Historic incidents or probable safety risks	3	1					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **STR_Secondary_Str_Systems**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

FACILITY CONDITION ASSESSMENT FORM
SECONDARY STRUCTURAL SYSTEMS

Assessor: Mark Baker
Date Assesed: 18-Apr-19

SECTION	ITEM	DATA		ASSESSMENT SCORES				AGE		
		Secondary Structural Components: - Stairs, ladders, handrails, guardrails, catwalks, mezzanines, hatches, davits, support brackets, equipment bases.		Current Physical Condition	Fitness For Purpose		Safety	Year Installed	Expected Service Life	Remaining Service Life
Tag: STR_Secondary_Str_Systems	GENERAL	CODE COMPLIANCE ISSUES: - Openings and the lower level walkway are missing guardrails, kickplates, gates, etc. - Hatch lids are subject to falling through the openings. SAFETY ISSUES: - The lower level walkway supports are deteriorating.		3.8	3.9		5.0	1960	30	0
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				1
	Current Physical Condition	**Stairs, Ladders, Catwalks, Rails, Hatches:** *Issues for Discussion:* - Corrosion of material, anchors - Hatch seals, operability, locks	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	4	0.5	*NOTES & COMMENTS:* *- Mid level steel cross beams show corrosion.* *- Lower level walkway is at end of its service life. Considerable corrosion on bolts and end plates.* *- Lower level hoist is corroded, hooks missing latches* *- Plywood interior finish on walls and ceiling is aged* *- All floor finishes are worn off* *- Hatch to lower level could fall through opening. Not Code compliant* *- No gate or railing at opening* *- Lower platform is not Code Compiant (railings, kick plate, etc)* *- Hoist is not able to deliver pumps to exterior of building*		
		Interior walls, Ceiling, Supports, Equipment Base: *Issues for Discussion:*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.2					
		Finishes: *Issues for Discussion:* - Floor, wall, ceiling paint. Finishes on doors, etc	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	4	0.1					
		Monorails and Hoists: *Issues for Discussion:* - Corrosion, anchor bolts, labels - Corrosive atmosphere	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	4	0.2					
	Fitness for Purpose	**Stairs, Ladders, Catwalks, Rails, Hatches:** *Issues for Discussion:* - Corrosion resistance of material - Suitable access to equipment, levels - Compliance with Codes and Standards	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	4	0.5					
		Interior walls, Ceiling, Supports, Equipment Base: *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.2					
		Finishes: *Issues for Discussion:* - Floor and wall protection.	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	5	0.1					
		Monorails and Hoists: *Issues for Discussion:* - Transport of equipment to accessible area - Certificated by others	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	4	0.2					
	Safety	**Public and Operator Safety:** *Issues for Discussion:* *- Potential safety hazards* - Evacuation of personnel (davit, gear, hatch locations)	Rating 1: No Public Safety issues Rating 3: No record of incidents,possible concerns Rating 5: Historic incidents or probable safety risks	5	1					

RECOMMENDATIONS:	*COST ESTIMATE*
- Replace lower level platform	$ 35,000.00
- Replace hoist and lifting sling / hooks	$ 5,000.00
- Epoxy coat floors	$ 20,000.00
- Repaint walls and ceiling	$ 15,000.00
- Replace lower monorail	$ 1,500.00
- Replace hatch with hinged, add railing and swing gate	$ 7,500.00
- Install roof access hatch for pump removal	$ 15,000.00

PHOTOGRAPHS




Project No.: 8400-001-00
Tag: **STR_Building_Envelope**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

FACILITY CONDITION ASSESSMENT FORM
BUILDING ENVELOPE

Assessor: Mark Baker
Date Assesed: 18-Apr-19

SECTION	ITEM	DATA		ASSESSMENT SCORES: Current Physical Condition	Fitness For Purpose		Safety	AGE: Year Installed	Expected Service Life	Remaining Service Life
Tag: STR_Building_Envelope	GENERAL	**Building Envelope Components:** - Siding, Doors, Windows, Insulation, Vapour Barrier, Liners, Flashings, Soffits, Sealants, Weatherstripping		3.8	3.4		1.0	1960	25	0
		CODE COMPLIANCE ISSUES:								
		SAFETY ISSUES:								
				Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)				1
	Current Physical Condition	**Exterior Siding, Windows, Doors:** *Issues for Discussion:* - Weathering, deterioration - Door swing, seals, locks - Graffitti, vandalism - UV breakdown	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	4	0.4	*NOTES & COMMENTS:* *- Exterior stucco and walls have numerous holes* *- Vapour barrier on wrong side of insulation added to interior walls , likely to result in condensation* *- hole on interior wall through vapour barrier and insulation* *- weather seal / threshold on door not sealing*			
		Insulation, Vapour Barrier, Interior Liner: *Issues for Discussion:* - Interior frost, condensation	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	4	0.4					
		Flashings, Soffits, Sealants, Weatherstripping: *Issues for Discussion:* - UV breakdown	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.2					
	Fitness for Purpose	**Exterior Siding, Windows, Doors:** *Issues for Discussion:* - Door size, durability of siding	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.4	*RECOMMENDATIONS:* / *COST ESTIMATE* Repair holes in exterior and interior — $ 3,500.00 Replace weatherstripping — $ 500.00				
		Insulation, Vapour Barrier, Interior Liner: *Issues for Discussion:* - Adequate insulation, durability of liner	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	4	0.4					
		Flashings, Soffits, Sealants, Weatherstripping: *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.2					
	Safety	**Public and Operator Safety:** *Issues for Discussion:* *- Potential safety hazards*	Rating 1: No Public Safety issues Rating 3: No record of incidents,possible concerns Rating 5: Historic incidents or probable safety risks	1	1					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **STR_Roofing**
Facility: St. Charles Lift Station

FACILITY CONDITION ASSESSMENT FORM
ROOFING

Assessor: Mark Baker
Date Assesed: 18-Apr-19

SECTION	ITEM	DATA		ASSESSMENT SCORES: Current Physical Condition	Fitness For Purpose		Safety	AGE: Year Installed	Expected Service Life	Remaining Service Life
Tag: STR_Roofing		**Roofing Components:** - Decking, insulation, membrane, skylights, hatches, penetrations, gutters, flashings, trim								
	GENERAL	CODE COMPLIANCE ISSUES:		3.0	2.3		1.0	1960	25	0
		SAFETY ISSUES:		Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)				3
	Current Physical Condition	**Roof Membrane, Insulation, Decking:** *Issues for Discussion:*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.5	*NOTES & COMMENTS:* *- Asphalt shingles appear weathered* *- flashing and trim weathered and dented*				
	Current Physical Condition	**Skylights, Hatches, Penetrations:** *Issues for Discussion:*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.3					
	Current Physical Condition	**Flashings, Trim, Gutters, Downspouts:** *Issues for Discussion:*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.2					
	Fitness for Purpose	**Roof Membrane, Insulation, Decking:** *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	2	0.5	*RECOMMENDATIONS:* Replace roofing, flashing, and trim		*COST ESTIMATE* $ 8,500.00		
	Fitness for Purpose	**Skylights, Hatches, Penetrations:** *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.3					
	Fitness for Purpose	**Flashings, Trim, Gutters, Downspouts:** *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	2	0.2					
	Safety	**Public and Operator Safety:** *Issues for Discussion:* - Roof Tie-off	Rating 1: No Public Safety issues Rating 3: No record of incidents,possible concerns Rating 5: Historic incidents or probable safety risks	1	1					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **STR_Building_Mechanical**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

FACILITY CONDITION ASSESSMENT FORM
BUILDING MECHANICAL

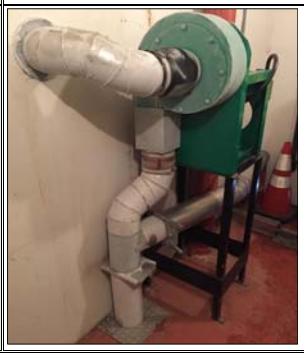
Assessor: Ryan Ursu
Date Assessed: 18-Apr-19

SECTION	ITEM	DATA		ASSESSMENT SCORES				AGE		
		Building Mechanical: - HVAC, Fire Suppression, Plumbing		Current Physical Condition	Fitness For Purpose		Safety	Year Installed	Expected Service Life	Remaining Service Life
Tag: STR_Building_Mechanical	GENERAL	CODE COMPLIANCE ISSUES: - There is no apparent Fire Suppression System. SAFETY ISSUES:		3.6	3.6		3.0	1960	25	0
				Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)				3
	Current Physical Condition	**Heating and Ventilation Systems:** *Issues for Discussion:*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.3	*NOTES & COMMENTS:* *- No apparent Fire Suppression System* *- Portable heater used on dry well floor. Susceptible to damage from leaks in process piping.*				
		Interior Plumbing: *Issues for Discussion:*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0.4					
		Fire Suppression Systems: *Issues for Discussion:*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	5	0.3					
	Fitness for Purpose	**Heating and Ventilation Systems:** *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.3	*RECOMMENDATIONS:* - Install Wall mount unit heater in vault and building c/w thermostat - Install handheld fire extinguisher by building entrance	*COST ESTIMATE* $ 2,500.00 $ 500.00			
		Interior Plumbing: *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	3	0.4					
		Fire Suppression Systems: *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	5	0.3					
	Safety	**Public and Operator Safety:** *Issues for Discussion:* - Monitors, Alarms	Rating 1: No Public Safety issues Rating 3: No record of incidents, possible concerns Rating 5: Historic incidents or probable safety risks	3	1					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **VENTILATON SYSTEM**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

VENTILATION CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19

SECTION	ITEM	DATA		ASSESSMENT SCORES				AGE		
		Ventilation Systems: - Wet Well, Dry Well		Current Physical Condition	Fitness For Purpose		Safety	YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Tag: VENTILATON SYSTEM	GENERAL	CODE COMPLIANCE ISSUES: - Dry well ventilation system is undersized. - Wet well and dry well piping is interconnected. SAFETY ISSUES: - Asbestos piping is used.		3.0	4.0		3.0	1960	25	0
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Wet Well Ventilation** *Issues for Discussion:*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	0	*NOTES & COMMENTS:* *- Ventilation system has exceeded its expected service life.* *- Wet well ventilation system is sufficiently sized for intended purpose.* *- Dry well ventilation system is undersized to meet NFPA 820 ventilation requirements of 30 air changes per hour when used intermittently.* *'- Wet well ventilation piping is interconnected with dry well piping.* *- Asbestos ventilation piping used.*		
		Dry Well Ventilation *Issues for Discussion:*	Rating 1 (Excellent Condition) Rating 2 (Good Condition) Rating 3 (Functional Condition) Rating 4 (Poor Condition) Rating 5 (Not Functional)	3	1					
	Fitness for Purpose	**Wet Well Ventilation** *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	4	0	*RECOMMENDATIONS:*	*COST ESTIMATE*			
		Dry Well Ventilation *Issues for Discussion:*	Rating 1 (Excellent - performs for intended purpose) Rating 2 (Good - well suited for intended purpose) Rating 3 (Functional - performs adequately) Rating 4 (Poor - not suitable for intended purpose) Rating 5 (Fail - does not meet any requirements)	4	1	Replace Dry Well Ventilation System	$ 38,000.00			
						Replace asbestos ventilation piping and remove interconnections in ventilation piping	$ 6,000.00			
	Safety	**Operator Safety** *Issues for Discussion:* *- Monitors, Alarms*	Rating 1: No safety hazard conditions Rating 3: No record of incidents, possible concerns Rating 5: Historic incidents or probable safety risks	3	1					
	PHOTOGRAPHS									

Condition Rating Summary

Ratings

Equipment Age and Service Life

SECTION	ITEM		DATA		CONDITION RATING				AGE		
					CONDITION	SCORE	IMPORTANCE	ACTION	YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
6.4 - Valves	Equipment Tag: Description: Knife Gate Valve	GENERAL	Location:	Dry well Lower Level	FAIR	3	4	4	0	25	0
			Description:	Knife Gate Valve							
			Size:	100 mm							
			Valve Make:	Orbinox							
			Valve Model:	10-2134R							
			Actuation:	Manual - Hand wheel							
			Actuator Make:	N/A							
			Actuator Model:	N/A							
		DEVICE	Equipment Visual Inspection:	No leaks Valve in fair condition	FAIR	3	*NOTES:*				
			Valve Corrosion Noted:	Exterior corrosion noted on valve flanges and bolts	FAIR	3					
			Condition of Valve Operator:	Operator is in fair visual condition, however valve is not exercised regularly	FAIR	3					
			Condition of Valve Accessories:	N/A			*COMMENTS AND RECOMMENDATIONS:* Valve is used for manual isolation of Pump 101. Surface Corrosion has been noted on the valve.				
		PERFORMANCE	Valve Performance/Ability to Seat:	No issues identified, however valve is not exercised regularly	FAIR	3					
		OPERATION	Operational Issues Identified:	No issues identified	FAIR	3					
		AGE	Equipment Remaining Service Life:	Valve has exceeded its expected service life	POOR	2					
		PHOTOGRAPHS									

Appendix B

Pumps Condition Assessment Forms

Project No.: 8400-001-00
Tag: **P_101**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

PUMP CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

Equipment Tag: P_101
Description: Dry Pit Solids Handling

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
	GENERAL	Location: Dry Well Lower Level Type: 10 HP Vertical End Suction Description: Dry Pit Solids Handling Manufacturer: Aurora Model: 664 SF RPM: 1200 Rated Voltage: 575 V Rated Current: 10.6 A		3.3	2.9	1.8		1993	25	0
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 3 (Minor Leaks) Rating 5 (Risk of Critical Failure)	3	0.2					
		Equipment Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.2					
		Condition of Pump Accessories: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.1					
		Rebuild Potential of Pump: *Issues for Discussion:*	Rating 1 (N/A - Pump is New) Rating 2 (Pump Re-Build Feasible) Rating 3 (Pump Rebuild / Replace Equally Feasible) Rating 4 (Approaching End of Useful Life) Rating 5 (At or Surpassed Useful Life)	3	0.2					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but Occasional) Rating 4 (Frequent) Rating 5 (Constant)	4	0.3					
	Fitness for Purpose	**Design Flow Rate:** *Issues for Discussion:*	Rating 1 (Pump consistently provides design flow rate) Rating 2 (Pump consistently provides +/- 10% of design flow rate) Rating 3 (Pump consistently provides +/- 25% of design flow rate) Rating 4 (Pump performance a potential issue during high flow events) Rating 5 (Pump performance a critical issue)	4	0.2					
		Pump Redundancy: *Issues for Discussion:*	Rating 1 (100% Redundancy) Rating 3 (50% Redundancy) Rating 5 (No Redundancy. Risk of Critical Failure)	3	0.2					
		Appropriate Pump Type for Application: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper pump selection for application. Risk of Critical Failure)	1	0.2					
		Available Water Supply for Pumps (If Required): *Issues for Discussion:*	Rating 1 (Yes) Rating 2 (No - Not required for installed pumping equipment) Rating 3 (Yes - Flow / pressure inadequate for installed pumping equipment) Rating 4 (No - Available source on site but not connected) Rating 5 (No - No available source)	1	0.1					
		Pump Capacity: *Issues for Discussion:*	Rating 1 (Pump has sufficient capacity for current and projected demand conditions) Rating 2 (Pump has sufficient capacity for current demand conditions with minor surplus) Rating 3 (Pump has sufficient capacity) Rating 4 (Pump does not meet current demand condition) Rating 5 (Pump is critically undersized and likelihood of station backup is high)	4	0.3					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.25					
		Piping/Equipment Interference with Pump Removal: *Issues for Discussion:*	Rating 1 (No interference) Rating 2 (Yes - Some minor piping/equipment interference with pump removal) Rating 3 (Yes - Piping/equipment interference causes minor alteration of work method) Rating 4 (Yes - Piping/equipment interference causes major alteration of work method) Rating 5 (Yes - Piping/equipment interference prevents safe removal of pumps)	2	0.2					
		Provision of Direct Lift Spot for Pump Removal: *Issues for Discussion:*	Rating 1 (Yes - Accessible unobstructed direct lift spot for pump removal) Rating 2 (Yes - Accessible direct lift spot for pump removal, with minor obstructions) Rating 3 (Yes - Direct lift spot with limited access and minor obstructions) Rating 4 (Yes - Direct lift spot with difficult access and major obstructions) Rating 5 (No provision for direct pump removal)	2	0.1					
		Pumping Equipment Uniformity: *Issues for Discussion:*	Rating 1 (Yes - All installed pumps are identical model and duty point) Rating 2 (Yes - All installed pumps are identical model with varying duty points) Rating 3 (No - All installed pumps are different models, but same manufacturer) Rating 4 (No - All installed pumps are different models and different manufacturers) Rating 5 (No - Pump record information (design duty point) is not known)	1	0.2					
		Availability of Spare Parts: *Issues for Discussion:*	Rating 1 (Yes - Spare parts readily available with < 6 week lead time) Rating 2 (Yes - Spare parts readily available with 6-8 week lead time) Rating 3 (Yes - Spare parts readily available with > 8 week lead time) Rating 4 (Yes - Select spare parts available with varying lead times) Rating 5 (No - Spare parts no longer available for this equipment)	2	0.25					

VIBRATION (in/s)

	X	Y	Z
Motor	0.00	0.00	0.00
Volute	0.00	0.00	0.00

NOTES & COMMENTS:

Pump is nearing the end of its service life.

The pumping system is capable of meeting the peak dry weather influent flow requirements, however the pumping system is not currently capable of meeting the peak wet weather influent flow requirements.

RECOMMENDATIONS	*COST ESTIMATE*
Replace Pump	$ 63,000.00

PHOTOGRAPHS

Project No.: 8400-001-00
Tag: **P_102**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

PUMP CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

Equipment Tag: P_102
Description: Dry Pit Solids Handling

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
	GENERAL	Location: Dry Well Lower Level Type: 10 HP Vertical End Suction Description: Dry Pit Solids Handling Manufacturer: Aurora Model: 664 SF RPM: 1200 Rated Voltage: 575 V Rated Current: 10.6 A		3.3	2.9	1.8		1993	25	0
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 3 (Minor Leaks) Rating 5 (Risk of Critical Failure)	3	0.2					
		Equipment Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.2					
		Condition of Pump Accessories: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.1					
		Rebuild Potential of Pump: *Issues for Discussion:*	Rating 1 (N/A - Pump is New) Rating 2 (Pump Re-Build Feasible) Rating 3 (Pump Rebuild / Replace Equally Feasible) Rating 4 (Approaching End of Useful Life) Rating 5 (At or Surpassed Useful Life)	3	0.2					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but Occasional) Rating 4 (Frequent) Rating 5 (Constant)	4	0.3					
	Fitness for Purpose	**Design Flow Rate:** *Issues for Discussion:*	Rating 1 (Pump consistently provides design flow rate) Rating 2 (Pump consistently provides +/- 10% of design flow rate) Rating 3 (Pump consistently provides +/- 25% of design flow rate) Rating 4 (Pump performance a potential issue during high flow events) Rating 5 (Pump performance a critical issue)	4	0.2					
		Pump Redundancy: *Issues for Discussion:*	Rating 1 (100% Redundancy) Rating 3 (50% Redundancy) Rating 5 (No Redundancy. Risk of Critical Failure)	3	0.2					
		Appropriate Pump Type for Application: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper pump selection for application. Risk of Critical Failure)	1	0.2					
		Available Water Supply for Pumps (If Required): *Issues for Discussion:*	Rating 1 (Yes) Rating 2 (No - Not required for installed pumping equipment) Rating 3 (Yes - Flow / pressure inadequate for installed pumping equipment) Rating 4 (No - Available source on site but not connected) Rating 5 (No - No available source)	1	0.1					
		Pump Capacity: *Issues for Discussion:*	Rating 1 (Pump has sufficient capacity for current and projected demand conditions) Rating 2 (Pump has sufficient capacity for current demand conditions with minor surplus) Rating 3 (Pump has sufficient capacity) Rating 4 (Pump does not meet current demand condition) Rating 5 (Pump is critically undersized and likelihood of station backup is high)	4	0.3					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.25					
		Piping/Equipment Interference with Pump Removal: *Issues for Discussion:*	Rating 1 (No interference) Rating 2 (Yes - Some minor piping/equipment interference with pump removal) Rating 3 (Yes - Piping/equipment interference causes minor alteration of work method) Rating 4 (Yes - Piping/equipment interference causes major alteration of work method) Rating 5 (Yes - Piping/equipment interference prevents safe removal of pumps)	2	0.2					
		Provision of Direct Lift Spot for Pump Removal: *Issues for Discussion:*	Rating 1 (Yes - Accessible unobstructed direct lift spot for pump removal) Rating 2 (Yes - Accessible direct lift spot for pump removal, with minor obstructions) Rating 3 (Yes - Direct lift spot with limited access and minor obstructions) Rating 4 (Yes - Direct lift spot with difficult access and major obstructions) Rating 5 (No provision for direct pump removal)	2	0.1					
		Pumping Equipment Uniformity: *Issues for Discussion:*	Rating 1 (Yes - All installed pumps are identical model and duty point) Rating 2 (Yes - All installed pumps are identical model with varying duty points) Rating 3 (No - All installed pumps are different models, but same manufacturer) Rating 4 (No - All installed pumps are different models and different manufacturers) Rating 5 (No - Pump record information (design duty point) is not known)	1	0.2					
		Availability of Spare Parts: *Issues for Discussion:*	Rating 1 (Yes - Spare parts readily available with < 6 week lead time) Rating 2 (Yes - Spare parts readily available with 6-8 week lead time) Rating 3 (Yes - Spare parts readily available with > 8 week lead time) Rating 4 (Yes - Select spare parts available with varying lead times) Rating 5 (No - Spare parts no longer available for this equipment)	2	0.25					

VIBRATION (in/s)

	X	Y	Z
Motor	0.15	0.31	0.11
Volute	0.00	0.00	0.00

NOTES & COMMENTS:

Pump is nearing the end of its service life.

The pumping system is capable of meeting the peak dry weather influent flow requirements, however the pumping system is not currently capable of meeting the peak wet weather influent flow requirements.

RECOMMENDATIONS	*COST ESTIMATE*
Replace Pump	$ 63,000.00

PHOTOGRAPHS

Appendix C

Electrical & Communication Condition Assessment Forms

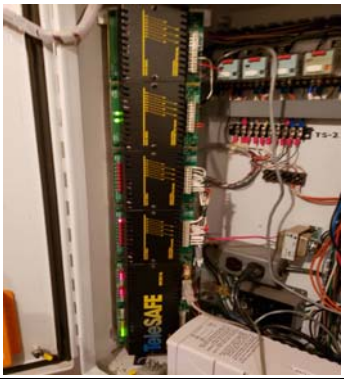
Do Not Delete
Review: 4
Total Cost: $ 40,000.00

Project No.: 8400-001-00
Tag: **IC_Panel**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

CONTROL PANEL CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19

Asset ID: 14908

SECTION	ITEM	DATA		Assessment Scores: Current Physical Condition	Assessment Scores: Fitness For Purpose	Component Age: YEAR INSTALLED	Component Age: EXPECTED SERVICE LIFE	Component Age: REMAINING SERVICE LIFE
Equipment Tag: IC_Panel Description: St.Charles Control Panel	GENERAL	Location:	Dry Well, Main Level	3.3	2.8	1995	25	1
		Description:	St.Charles Control Panel					
		Function:	Alarm Reporting					
		PLC Processor:	SCADAPack Micro 16					
		UPS Protection:	Yes					
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)		**4**
	Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	2	0.1	*NOTES & COMMENTS:* *Flow Meter Needed. New stations have control redundency*		
		Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4			
		Control Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	3	0.1			
		Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.4			
	Fitness for Purpose	**Controls Functioning as Expected:** *Issues for Discussion:*	Rating 1 (Always) Rating 2 (More than half of time) Rating 3 (Half of the time) Rating 4 (Less often than half) Rating 5 (Never)	1	0.3	*RECOMMENDATIONS:* Replace with controls meeting current design guidelines. Relocate Control Panel Location. Move Milltronics outside of cabinet. Upsize Cabinet or move UPS to the exterior of cabinet.	*COST ESTIMATE* $ 40,000.00	
		Panel is Appropriately Designed: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	3	0.1			
		Control Logic is Appropriate for Installation: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	3	0.3			
		Communications Equipment is Appropriate: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	5	0.1			
		Equipment Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	4	0.2			
	PHOTOGRAPHS							

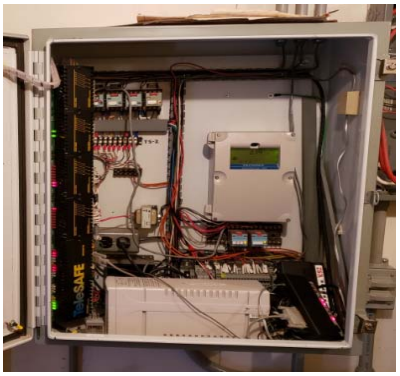
Do Not Delete
Review: 4
Total Cost: $ 2,000.00

Project No.: 8400-001-00
Tag: **IC_UPS**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

UPS CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19

Asset ID: 14909

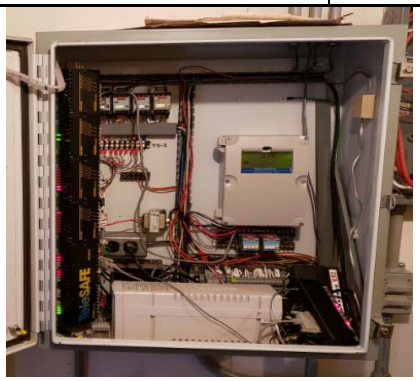
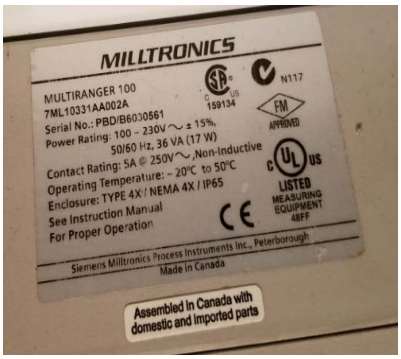
SECTION	ITEM	DATA		Assessment Scores: Current Physical Condition	Assessment Scores: Fitness For Purpose			Component Age: YEAR INSTALLED	Component Age: EXPECTED SERVICE LIFE	Component Age: REMAINING SERVICE LIFE
Equipment Tag: IC_UPS Description: St.Charles UPS	GENERAL	Location: Dry Well, Main Level Description: St.Charles UPS Make: Model: Rated VA:		3.1	3.4			1995	25	1
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**4**
	Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	1	0.1	*NOTES & COMMENTS:* Battery expires Dec 2020. UPS only lasts 10 Minutes. New stations use a 24VDC				
		Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4					
		Control Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	0	0					
		Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.5	*RECOMMENDATIONS:* Install a new UPS when updating the control Panel	*COST ESTIMATE* $ 2,000.00			
	Fitness for Purpose	**UPS system is Present & Designed Appropriately:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	3	0.2					
		UPS External Maintenance Bypass is Installed: *Issues for Discussion:*	Rating 1 (Yes) Rating 5 (No)	5	0.1					
		UPS Redundancy is Required / Installed: *Issues for Discussion:*	Rating 1 (Yes or Not Required) Rating 3 (Required, non standard) Rating 5 (Required, not installed)	1	0.1					
		UPS is Sized Appropriately: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (Load > 80% or Runtime below design guidelines) Rating 5 (Load and Runtime outside guidelines)	3	0.2					
		UPS Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	4	0.4					
	PHOTOGRAPHS	  								

Project No.: 8400-001-00
Tag: **IC_Instrument_1**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

INSTRUMENTATION CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19

Asset ID: 14911

SECTION	ITEM	DATA		Assessment Scores: Current Physical Condition	Assessment Scores: Fitness For Purpose			AGE: YEAR INSTALLED	AGE: EXPECTED SERVICE LIFE	AGE: REMAINING SERVICE LIFE
Equipment Tag: IC_Instrument_1 Description: Milltronics Multiranger 100	GENERAL	Location:	Dry Well, Main Level	2.7	1.5			1995	20	0
		Description:	Milltronics Multiranger 100							
		Make:	Milltronics							
		Model:	Multiranger 100							
		Device Span:								
		Input/Output:								
		Signal Type:								
		Rated Voltage:								
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**4**
	Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	1	0.1	*NOTES & COMMENTS:* *Milltronics appears to be in "GOOD" condition.*				
		Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4					
		Control Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	2	0.1					
		Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	1	0.4	*RECOMMENDATIONS:*		*COST ESTIMATE*		
	Fitness for Purpose	**Instrument/Measurement is Designed Appropriately:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	1	0.3	Move outside of Control Panels so operations can see without having to be in the control panel.		$ 1,500.00		
		Instrument Redundancy is Required/Installed: *Issues for Discussion:*	Rating 1 (Yes or Not Required) Rating 3 (Required, non standard) Rating 5 (Required, not installed)	1	0.1					
		Instrument Range is Appropriate: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	1	0.1					
		Instrument Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	2	0.5					
	PHOTOGRAPHS									

Appendix D

Pipe Work & Valves Condition Assessment Forms

Project No.: 8400-001-00
Tag: **GAV_101A**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

VALVE CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: GAV_101A Description: Gate Valve	GENERAL	Location:	Dry Well Lower Level	2.5	1.0	1.6		1993	25	0
		Description:	Gate Valve							
		Size:	150 mm							
		Valve Make:	Clow							
		Valve Model:	2660							
		Actuation:	Manual - Hand Wheel							
		Actuator Make:	N/A							
		Actuator Model:	N/A							
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Valve Visual Inspection:** *Issues for Discussion:*	Rating 1 (New) Rating 2 (Good condition, functions well) Rating 3 (Fair condition) Rating 4 (Minor leaks) Rating 5 (Risk of critical failure)	3	0.2	*NOTES & COMMENTS:* *Valve is nearing the end of its service life and should be replaced.*				
		Valve Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like new) Rating 2 (Minor surface corrosion) Rating 3 (Surface & internal corrosion) Rating 4 (Extensive corrosion) Rating 5 (Corrosion affects opperability)	2	0.2					
		Valve Operation: *Issues for Discussion:*	Rating 1 (New) Rating 2 (Valve functions well) Rating 3 (Functions but with difficulty) Rating 4 (Valve operable but exceeds service life) Rating 5 (No - Valve inoperable)	3	0.3					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.3					
	Fitness For Purpose	**Appropriate Valve Configuration:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper valve configuration for application. Risk of Critical Failure)	1	0.3	*RECOMMENDATIONS:* Replace Valve	*COST ESTIMATE* $ 5,400.00			
		Valve Capacity: *Issues for Discussion:*	Rating 1 (Valve size sufficient for current and projected demand conditions) Rating 2 (Valve size sufficient for current demand conditions with minor surplus) Rating 3 (Valve size sufficient) Rating 4 (Valve size does not meet current demand condition) Rating 5 (Valve is critically undersized and likelihood of station backup is high)	1	0.7					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Sufficient Access to Exercise Valve: *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of valve operation) Rating 4 (No - Access restrictions cause significant alteration of valve operation) Rating 5 (No - Access restrictions prevent safe operation of valve)	1	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **GAV_101B**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

VALVE CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: GAV_101B Description: Gate Valve	GENERAL	Location:	Dry Well Lower Level	2.5	1.0	1.6		1993	25	0
		Description:	Gate Valve							
		Size:	150 mm							
		Valve Make:	Clow							
		Valve Model:	2660							
		Actuation:	Manual - Hand Wheel							
		Actuator Make:	N/A							
		Actuator Model:	N/A	**Rating**	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Valve Visual Inspection:** *Issues for Discussion:*	Rating 1 (New) Rating 2 (Good condition, functions well) Rating 3 (Fair condition) Rating 4 (Minor leaks) Rating 5 (Risk of critical failure)	3	0.2	*NOTES & COMMENTS:* *Valve is nearing the end of its service life and should be replaced.*				
		Valve Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like new) Rating 2 (Minor surface corrosion) Rating 3 (Surface & internal corrosion) Rating 4 (Extensive corrosion) Rating 5 (Corrosion affects opperability)	2	0.2					
		Valve Operation: *Issues for Discussion:*	Rating 1 (New) Rating 2 (Valve functions well) Rating 3 (Functions but with difficulty) Rating 4 (Valve operable but exceeds service life) Rating 5 (No - Valve inoperable)	3	0.3					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.3					
	Fitness For Purpose	**Appropriate Valve Configuration:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper valve configuration for application. Risk of Critical Failure)	1	0.3	*RECOMMENDATIONS:* Replace Valve	*COST ESTIMATE* $ 5,400.00			
		Valve Capacity: *Issues for Discussion:*	Rating 1 (Valve size sufficient for current and projected demand conditions) Rating 2 (Valve size sufficient for current demand conditions with minor surplus) Rating 3 (Valve size sufficient) Rating 4 (Valve size does not meet current demand condition) Rating 5 (Valve is critically undersized and likelihood of station backup is high)	1	0.7					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Sufficient Access to Exercise Valve: *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of valve operation) Rating 4 (No - Access restrictions cause significant alteration of valve operation) Rating 5 (No - Access restrictions prevent safe operation of valve)	1	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **GAV_102A**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

VALVE CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: GAV_102A Description: Gate Valve	GENERAL	Location:	Dry Well Lower Level	2.5	1.0	1.6		1993	25	0
		Description:	Gate Valve							
		Size:	150 mm							
		Valve Make:	Clow							
		Valve Model:	2660							
		Actuation:	Manual - Hand Wheel							
		Actuator Make:	N/A							
		Actuator Model:	N/A	**Rating**	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Valve Visual Inspection:** *Issues for Discussion:*	Rating 1 (New) Rating 2 (Good condition, functions well) Rating 3 (Fair condition) Rating 4 (Minor leaks) Rating 5 (Risk of critical failure)	3	0.2	*NOTES & COMMENTS:* *Valve is nearing the end of its service life and should be replaced.*				
		Valve Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like new) Rating 2 (Minor surface corrosion) Rating 3 (Surface & internal corrosion) Rating 4 (Extensive corrosion) Rating 5 (Corrosion affects opperability)	2	0.2					
		Valve Operation: *Issues for Discussion:*	Rating 1 (New) Rating 2 (Valve functions well) Rating 3 (Functions but with difficulty) Rating 4 (Valve operable but exceeds service life) Rating 5 (No - Valve inoperable)	3	0.3					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.3					
	Fitness For Purpose	**Appropriate Valve Configuration:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper valve configuration for application. Risk of Critical Failure)	1	0.3	*RECOMMENDATIONS:* Replace Valve	*COST ESTIMATE* $ 5,400.00			
		Valve Capacity: *Issues for Discussion:*	Rating 1 (Valve size sufficient for current and projected demand conditions) Rating 2 (Valve size sufficient for current demand conditions with minor surplus) Rating 3 (Valve size sufficient) Rating 4 (Valve size does not meet current demand condition) Rating 5 (Valve is critically undersized and likelihood of station backup is high)	1	0.7					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Sufficient Access to Exercise Valve: *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of valve operation) Rating 4 (No - Access restrictions cause significant alteration of valve operation) Rating 5 (No - Access restrictions prevent safe operation of valve)	1	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **GAV_102B**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

VALVE CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: GAV_102B Description: Gate Valve	GENERAL	Location: Dry Well Lower Level Description: Gate Valve Size: 150 mm Valve Make: Clow Valve Model: 2660 Actuation: Manual - Hand Wheel Actuator Make: N/A Actuator Model: N/A		2.5	1.0	1.6		1993	25	0
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Valve Visual Inspection:** *Issues for Discussion:*	Rating 1 (New) Rating 2 (Good condition, functions well) Rating 3 (Fair condition) Rating 4 (Minor leaks) Rating 5 (Risk of critical failure)	3	0.2	*NOTES & COMMENTS:* *Valve is nearing the end of its service life and should be replaced.*				
		Valve Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like new) Rating 2 (Minor surface corrosion) Rating 3 (Surface & internal corrosion) Rating 4 (Extensive corrosion) Rating 5 (Corrosion affects opperability)	2	0.2					
		Valve Operation: *Issues for Discussion:*	Rating 1 (New) Rating 2 (Valve functions well) Rating 3 (Functions but with difficulty) Rating 4 (Valve operable but exceeds service life) Rating 5 (No - Valve inoperable)	3	0.3					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.3					
	Fitness For Purpose	**Appropriate Valve Configuration:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper valve configuration for application. Risk of Critical Failure)	1	0.3	*RECOMMENDATIONS:* Replace Valve	*COST ESTIMATE* $ 5,400.00			
		Valve Capacity: *Issues for Discussion:*	Rating 1 (Valve size sufficient for current and projected demand conditions) Rating 2 (Valve size sufficient for current demand conditions with minor surplus) Rating 3 (Valve size sufficient) Rating 4 (Valve size does not meet current demand condition) Rating 5 (Valve is critically undersized and likelihood of station backup is high)	1	0.7					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Sufficient Access to Exercise Valve: *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of valve operation) Rating 4 (No - Access restrictions cause significant alteration of valve operation) Rating 5 (No - Access restrictions prevent safe operation of valve)	1	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **GAV_103**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

VALVE CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

Equipment Tag: GAV_103
Description: Gate Valve

GENERAL

Location:	Dry Well Lower Level
Description:	Gate Valve
Size:	150 mm
Valve Make:	Clow
Valve Model:	2660
Actuation:	Manual - Direct Nut
Actuator Make:	N/A
Actuator Model:	N/A

CONDITION RATING				AGE		
Current Physical Condition	Fitness For Purpose	Maintenance & Operation		YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
2.5	1.0	2.0		1993	25	0

Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)	3

Current Physical Condition

DATA		Rating	Weight
Valve Visual Inspection: *Issues for Discussion:*	Rating 1 (New) Rating 2 (Good condition, functions well) Rating 3 (Fair condition) Rating 4 (Minor leaks) Rating 5 (Risk of critical failure)	3	0.2
Valve Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like new) Rating 2 (Minor surface corrosion) Rating 3 (Surface & internal corrosion) Rating 4 (Extensive corrosion) Rating 5 (Corrosion affects opperability)	2	0.2
Valve Operation: *Issues for Discussion:*	Rating 1 (New) Rating 2 (Valve functions well) Rating 3 (Functions but with difficulty) Rating 4 (Valve operable but exceeds service life) Rating 5 (No - Valve inoperable)	3	0.3
Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.3

NOTES & COMMENTS:
Valve is nearing the end of its service life and should be replaced.

Fitness For Purpose

DATA		Rating	Weight
Appropriate Valve Configuration: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper valve configuration for application. Risk of Critical Failure)	1	0.3
Valve Capacity: *Issues for Discussion:*	Rating 1 (Valve size sufficient for current and projected demand conditions) Rating 2 (Valve size sufficient for current demand conditions with minor surplus) Rating 3 (Valve size sufficient) Rating 4 (Valve size does not meet current demand condition) Rating 5 (Valve is critically undersized and likelihood of station backup is high)	1	0.7

RECOMMENDATIONS:	*COST ESTIMATE*
Replace Valve	$ 5,400.00

Maintainability and Operability

DATA		Rating	Weight
Sufficient Access to Perform O&M Activities Safely: *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6
Sufficient Access to Exercise Valve: *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of valve operation) Rating 4 (No - Access restrictions cause significant alteration of valve operation) Rating 5 (No - Access restrictions prevent safe operation of valve)	2	0.4

PHOTOGRAPHS

Project No.: 8400-001-00
Tag: **GAV_104**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

VALVE CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: GAV_104 Description: Gate Valve	GENERAL	Location:	Dry Well Lower Level	2.5	1.0	2.0		1993	25	0
		Description:	Gate Valve							
		Size:	150 mm							
		Valve Make:	Clow							
		Valve Model:	2660							
		Actuation:	Manual - Direct Nut							
		Actuator Make:	N/A							
		Actuator Model:	N/A							
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Valve Visual Inspection:** *Issues for Discussion:*	Rating 1 (New) Rating 2 (Good condition, functions well) Rating 3 (Fair condition) Rating 4 (Minor leaks) Rating 5 (Risk of critical failure)	3	0.2	*NOTES & COMMENTS:* *Valve is nearing the end of its service life and should be replaced.*				
		Valve Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like new) Rating 2 (Minor surface corrosion) Rating 3 (Surface & internal corrosion) Rating 4 (Extensive corrosion) Rating 5 (Corrosion affects opperability)	2	0.2					
		Valve Operation: *Issues for Discussion:*	Rating 1 (New) Rating 2 (Valve functions well) Rating 3 (Functions but with difficulty) Rating 4 (Valve operable but exceeds service life) Rating 5 (No - Valve inoperable)	3	0.3					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.3					
	Fitness For Purpose	**Appropriate Valve Configuration:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper valve configuration for application. Risk of Critical Failure)	1	0.3	*RECOMMENDATIONS:* Replace Valve	*COST ESTIMATE* $ 5,400.00			
		Valve Capacity: *Issues for Discussion:*	Rating 1 (Valve size sufficient for current and projected demand conditions) Rating 2 (Valve size sufficient for current demand conditions with minor surplus) Rating 3 (Valve size sufficient) Rating 4 (Valve size does not meet current demand condition) Rating 5 (Valve is critically undersized and likelihood of station backup is high)	1	0.7					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Sufficient Access to Exercise Valve: *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of valve operation) Rating 4 (No - Access restrictions cause significant alteration of valve operation) Rating 5 (No - Access restrictions prevent safe operation of valve)	2	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **CHV_101**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

VALVE CONDITION ASSESSMENT FORM

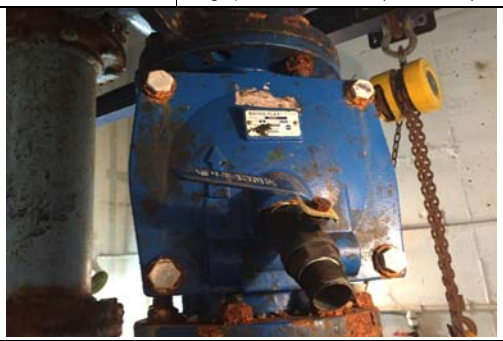
Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: CHV_101 Description: Swing Check Valve	GENERAL	Location:	Dry Well Lower Level	2.5	1.0	2.0		1993	25	0
		Description:	Swing Check Valve							
		Size:	150 mm							
		Valve Make:	Val-Matic							
		Valve Model:	506C							
		Actuation:	N/A							
		Actuator Make:	N/A							
		Actuator Model:	N/A	**Rating**	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Valve Visual Inspection:** *Issues for Discussion:*	Rating 1 (New) Rating 2 (Good condition, functions well) Rating 3 (Fair condition) Rating 4 (Minor leaks) Rating 5 (Risk of critical failure)	3	0.2	*NOTES & COMMENTS:* *Valve is nearing the end of its service life and should be replaced.*				
		Valve Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like new) Rating 2 (Minor surface corrosion) Rating 3 (Surface & internal corrosion) Rating 4 (Extensive corrosion) Rating 5 (Corrosion affects opperability)	2	0.2					
		Valve Operation: *Issues for Discussion:*	Rating 1 (New) Rating 2 (Valve functions well) Rating 3 (Functions but with difficulty) Rating 4 (Valve operable but exceeds service life) Rating 5 (No - Valve inoperable)	3	0.3					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.3					
	Fitness For Purpose	**Appropriate Valve Configuration:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper valve configuration for application. Risk of Critical Failure)	1	0.3	*RECOMMENDATIONS:* Replace Valve	*COST ESTIMATE* $ 3,500.00			
		Valve Capacity: *Issues for Discussion:*	Rating 1 (Valve size sufficient for current and projected demand conditions) Rating 2 (Valve size sufficient for current demand conditions with minor surplus) Rating 3 (Valve size sufficient) Rating 4 (Valve size does not meet current demand condition) Rating 5 (Valve is critically undersized and likelihood of station backup is high)	1	0.7					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Sufficient Access to Exercise Valve: *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of valve operation) Rating 4 (No - Access restrictions cause significant alteration of valve operation) Rating 5 (No - Access restrictions prevent safe operation of valve)	2	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **CHV_102**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

VALVE CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: CHV_102 Description: Swing Check Valve	GENERAL	Location:	Dry Well Lower Level	2.5	1.0	2.0		1993	25	0
		Description:	Swing Check Valve							
		Size:	150 mm							
		Valve Make:	Val-Matic							
		Valve Model:	506C							
		Actuation:	N/A							
		Actuator Make:	N/A							
		Actuator Model:	N/A	**Rating**	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Valve Visual Inspection:** *Issues for Discussion:*	Rating 1 (New) Rating 2 (Good condition, functions well) Rating 3 (Fair condition) Rating 4 (Minor leaks) Rating 5 (Risk of critical failure)	3	0.2	*NOTES & COMMENTS:* *Valve is nearing the end of its service life and should be replaced.*				
		Valve Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like new) Rating 2 (Minor surface corrosion) Rating 3 (Surface & internal corrosion) Rating 4 (Extensive corrosion) Rating 5 (Corrosion affects opperability)	2	0.2					
		Valve Operation: *Issues for Discussion:*	Rating 1 (New) Rating 2 (Valve functions well) Rating 3 (Functions but with difficulty) Rating 4 (Valve operable but exceeds service life) Rating 5 (No - Valve inoperable)	3	0.3					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.3					
	Fitness For Purpose	**Appropriate Valve Configuration:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper valve configuration for application. Risk of Critical Failure)	1	0.3	*RECOMMENDATIONS:* Replace Valve	*COST ESTIMATE* $ 3,500.00			
		Valve Capacity: *Issues for Discussion:*	Rating 1 (Valve size sufficient for current and projected demand conditions) Rating 2 (Valve size sufficient for current demand conditions with minor surplus) Rating 3 (Valve size sufficient) Rating 4 (Valve size does not meet current demand condition) Rating 5 (Valve is critically undersized and likelihood of station backup is high)	1	0.7					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Sufficient Access to Exercise Valve: *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of valve operation) Rating 4 (No - Access restrictions cause significant alteration of valve operation) Rating 5 (No - Access restrictions prevent safe operation of valve)	2	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **KGV_101**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

VALVE CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

Equipment Tag: KGV_101
Description: Knife Gate Valve

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
	GENERAL	Location:	Dry Well Lower Level							
		Description:	Knife Gate Valve							
		Size:	150 mm							
		Valve Make:	N/A	2.5	1.0	2.0		1993	25	0
		Valve Model:	N/A							
		Actuation:	Manual - Hand Wheel							
		Actuator Make:	N/A							
		Actuator Model:	N/A							
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Valve Visual Inspection:** *Issues for Discussion:*	Rating 1 (New) Rating 2 (Good condition, functions well) Rating 3 (Fair condition) Rating 4 (Minor leaks) Rating 5 (Risk of critical failure)	3	0.2	*NOTES & COMMENTS:* *Valve is nearing the end of its service life and should be replaced.*				
		Valve Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like new) Rating 2 (Minor surface corrosion) Rating 3 (Surface & internal corrosion) Rating 4 (Extensive corrosion) Rating 5 (Corrosion affects opperability)	2	0.2					
		Valve Operation: *Issues for Discussion:*	Rating 1 (New) Rating 2 (Valve functions well) Rating 3 (Functions but with difficulty) Rating 4 (Valve operable but exceeds service life) Rating 5 (No - Valve inoperable)	3	0.3					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.3					
	Fitness For Purpose	**Appropriate Valve Configuration:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper valve configuration for application. Risk of Critical Failure)	1	0.3	*RECOMMENDATIONS:* Replace Valve	*COST ESTIMATE* $ 5,400.00			
		Valve Capacity: *Issues for Discussion:*	Rating 1 (Valve size sufficient for current and projected demand conditions) Rating 2 (Valve size sufficient for current demand conditions with minor surplus) Rating 3 (Valve size sufficient) Rating 4 (Valve size does not meet current demand condition) Rating 5 (Valve is critically undersized and likelihood of station backup is high)	1	0.7					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Sufficient Access to Exercise Valve: *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of valve operation) Rating 4 (No - Access restrictions cause significant alteration of valve operation) Rating 5 (No - Access restrictions prevent safe operation of valve)	2	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **P_P101_Suction**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

PIPING CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: P_P101_Suction Description: P-101 Suction Line	GENERAL	Location:	Dry Well Lower Level							
		Description:	P-101 Suction Line							
		Size:	150 mm	2.4	1.4	1.6		1993	50	24
		Material:	Carbon Steel							
		Service:	Sewage							
		Coating:	Epoxy							
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Piping Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 3 (Minor Leaks) Rating 5 (Risk of Critical Failure)	3	0.3	*NOTES & COMMENTS:* *Surface corrosion noted on piping.* *Some of the older piping is nearing the end of its service life.*				
		Piping Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.4					
		Condition of Potable Water Piping and Backflow *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	0	0					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but Occasional) Rating 4 (Frequent) Rating 5 (Constant)	1	0.3					
	Fitness for Purpose	**Force Main Shut Off Valve:** *Issues for Discussion:*	Rating 1 (Yes - Valve functions) Rating 3 (Yes - Valve does not operate) Rating 5 (No)	1	0.3					
		Flow Meter Installed: *Issues for Discussion:*	Rating 1 (Yes - Flow meter is accurate) Rating 3 (Yes - Flow meter not accurate) Rating 5 (No)	3	0.2	*RECOMMENDATIONS:* Replace piping	*COST ESTIMATE* $ 2,000.00			
		Appropriate Piping Configuration: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper piping configuration for application. Risk of Critical Failure)	1	0.1					
		Piping Capacity: *Issues for Discussion:*	Rating 1 (Piping has sufficient capacity for current and projected demand conditions) Rating 2 (Piping has sufficient capacity for current demand conditions with minor surplus) Rating 3 (Piping has sufficient capacity) Rating 4 (Piping does not meet current demand condition) Rating 5 (Piping is critically undersized and likelihood of station backup is high)	1	0.4					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Isolation Valves Installed: *Issues for Discussion:*	Rating 1 (Yes) Rating 5 (No)	1	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **P_P102_Suction**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

PIPING CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: P_P102_Suction Description: P-102 Suction Line	GENERAL	Location: Dry Well Lower Level Description: P-102 Suction Line Size: 150 mm Material: Carbon Steel Service: Sewage Coating: Epoxy		2.4	1.4	1.6		1993	50	24
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Piping Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 3 (Minor Leaks) Rating 5 (Risk of Critical Failure)	3	0.3	*NOTES & COMMENTS:* *Surface corrosion noted on piping.* *Some of the older piping is nearing the end of its service life.*				
		Piping Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.4					
		Condition of Potable Water Piping and Backflow *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	0	0					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but Occasional) Rating 4 (Frequent) Rating 5 (Constant)	1	0.3					
	Fitness for Purpose	**Force Main Shut Off Valve:** *Issues for Discussion:*	Rating 1 (Yes - Valve functions) Rating 3 (Yes - Valve does not operate) Rating 5 (No)	1	0.3					
		Flow Meter Installed: *Issues for Discussion:*	Rating 1 (Yes - Flow meter is accurate) Rating 3 (Yes - Flow meter not accurate) Rating 5 (No)	3	0.2	*RECOMMENDATIONS:* Replace piping	*COST ESTIMATE* $ 2,000.00			
		Appropriate Piping Configuration: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper piping configuration for application. Risk of Critical Failure)	1	0.1					
		Piping Capacity: *Issues for Discussion:*	Rating 1 (Piping has sufficient capacity for current and projected demand conditions) Rating 2 (Piping has sufficient capacity for current demand conditions with minor surplus) Rating 3 (Piping has sufficient capacity) Rating 4 (Piping does not meet current demand condition) Rating 5 (Piping is critically undersized and likelihood of station backup is high)	1	0.4					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Isolation Valves Installed: *Issues for Discussion:*	Rating 1 (Yes) Rating 5 (No)	1	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **P_P101_Discharge**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

PIPING CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: P_P101_Discharge Description: P-101 Discharge Line	GENERAL	Location: Dry Well Lower Level Description: P-101 Discharge Line Size: 150 mm Material: Carbon Steel Service: Sewage Coating: Epoxy		2.4	1.4	1.6		1993	50	24
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Piping Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 3 (Minor Leaks) Rating 5 (Risk of Critical Failure)	3	0.3	*NOTES & COMMENTS:* *Surface corrosion noted on piping.* *Some of the older piping is nearing the end of its service life.*				
		Piping Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.4					
		Condition of Potable Water Piping and Backflow *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	0	0					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but Occasional) Rating 4 (Frequent) Rating 5 (Constant)	1	0.3					
	Fitness for Purpose	**Force Main Shut Off Valve:** *Issues for Discussion:*	Rating 1 (Yes - Valve functions) Rating 3 (Yes - Valve does not operate) Rating 5 (No)	1	0.3					
		Flow Meter Installed: *Issues for Discussion:*	Rating 1 (Yes - Flow meter is accurate) Rating 3 (Yes - Flow meter not accurate) Rating 5 (No)	3	0.2	*RECOMMENDATIONS:* Replace piping	*COST ESTIMATE* $ 4,000.00			
		Appropriate Piping Configuration: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper piping configuration for application. Risk of Critical Failure)	1	0.1					
		Piping Capacity: *Issues for Discussion:*	Rating 1 (Piping has sufficient capacity for current and projected demand conditions) Rating 2 (Piping has sufficient capacity for current demand conditions with minor surplus) Rating 3 (Piping has sufficient capacity) Rating 4 (Piping does not meet current demand condition) Rating 5 (Piping is critically undersized and likelihood of station backup is high)	1	0.4					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Isolation Valves Installed: *Issues for Discussion:*	Rating 1 (Yes) Rating 5 (No)	1	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **P_P102_Discharge**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

PIPING CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
Equipment Tag: P_P102_Discharge Description: P-102 Discharge Line	GENERAL	Location: Dry Well Lower Level Description: P-102 Discharge Line Size: 150 mm Material: Carbon Steel Service: Sewage Coating: Epoxy		2.4	1.4	1.6		1993	50	24
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Piping Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 3 (Minor Leaks) Rating 5 (Risk of Critical Failure)	3	0.3	*NOTES & COMMENTS:* *Surface corrosion noted on piping.* *Some of the older piping is nearing the end of its service life.*				
		Piping Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.4					
		Condition of Potable Water Piping and Backflow *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	0	0					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but Occasional) Rating 4 (Frequent) Rating 5 (Constant)	1	0.3					
	Fitness for Purpose	**Force Main Shut Off Valve:** *Issues for Discussion:*	Rating 1 (Yes - Valve functions) Rating 3 (Yes - Valve does not operate) Rating 5 (No)	1	0.3					
		Flow Meter Installed: *Issues for Discussion:*	Rating 1 (Yes - Flow meter is accurate) Rating 3 (Yes - Flow meter not accurate) Rating 5 (No)	3	0.2	*RECOMMENDATIONS:* Replace piping	*COST ESTIMATE* $ 4,000.00			
		Appropriate Piping Configuration: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper piping configuration for application. Risk of Critical Failure)	1	0.1					
		Piping Capacity: *Issues for Discussion:*	Rating 1 (Piping has sufficient capacity for current and projected demand conditions) Rating 2 (Piping has sufficient capacity for current demand conditions with minor surplus) Rating 3 (Piping has sufficient capacity) Rating 4 (Piping does not meet current demand condition) Rating 5 (Piping is critically undersized and likelihood of station backup is high)	1	0.4					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Isolation Valves Installed: *Issues for Discussion:*	Rating 1 (Yes) Rating 5 (No)	1	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **P_Discharge_HDR**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

PIPING CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

Equipment Tag: P_Discharge_HDR
Description: Discharge Header

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
	GENERAL	Location: Dry Well Lower Level Description: Discharge Header Size: 150 mm Material: Carbon Steel Service: Sewage Coating: Epoxy		2.4	1.4	1.6		1993	50	24
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Piping Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 3 (Minor Leaks) Rating 5 (Risk of Critical Failure)	3	0.3	*NOTES & COMMENTS:* *Surface corrosion noted on piping.* *Some of the older piping is nearing the end of its service life.*				
		Piping Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.4					
		Condition of Potable Water Piping and Backflow *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	0	0					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but Occasional) Rating 4 (Frequent) Rating 5 (Constant)	1	0.3					
	Fitness for Purpose	**Force Main Shut Off Valve:** *Issues for Discussion:*	Rating 1 (Yes - Valve functions) Rating 3 (Yes - Valve does not operate) Rating 5 (No)	1	0.3					
		Flow Meter Installed: *Issues for Discussion:*	Rating 1 (Yes - Flow meter is accurate) Rating 3 (Yes - Flow meter not accurate) Rating 5 (No)	3	0.2	*RECOMMENDATIONS:* Replace Piping	*COST ESTIMATE* $ 14,000.00			
		Appropriate Piping Configuration: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper piping configuration for application. Risk of Critical Failure)	1	0.1					
		Piping Capacity: *Issues for Discussion:*	Rating 1 (Piping has sufficient capacity for current and projected demand conditions) Rating 2 (Piping has sufficient capacity for current demand conditions with minor surplus) Rating 3 (Piping has sufficient capacity) Rating 4 (Piping does not meet current demand condition) Rating 5 (Piping is critically undersized and likelihood of station backup is high)	1	0.4					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Isolation Valves Installed: *Issues for Discussion:*	Rating 1 (Yes) Rating 5 (No)	1	0.4					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **P_Backflush**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

PIPING CONDITION ASSESSMENT FORM

Assessor: Ryan Ursu
Date: 18-Apr-19
Asset ID:

Equipment Tag: P_Backflush
Description: Backflush Line

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose	Maintenance & Operation		AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
	GENERAL	Location: Dry Well Lower Level Description: Backflush Line Size: 150 mm Material: Carbon Steel Service: Sewage Coating: Epoxy		2.4	1.4	1.6		1993	50	24
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**3**
	Current Physical Condition	**Piping Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 3 (Minor Leaks) Rating 5 (Risk of Critical Failure)	3	0.3	*NOTES & COMMENTS:* *Surface corrosion noted on piping.* *Some of the older piping is nearing the end of its service life.*				
		Piping Corrosion Noted: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.4					
		Condition of Potable Water Piping and Backflow *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	0	0					
		Occurrence of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but Occasional) Rating 4 (Frequent) Rating 5 (Constant)	1	0.3					
	Fitness for Purpose	**Force Main Shut Off Valve:** *Issues for Discussion:*	Rating 1 (Yes - Valve functions) Rating 3 (Yes - Valve does not operate) Rating 5 (No)	1	0.3					
		Flow Meter Installed: *Issues for Discussion:*	Rating 1 (Yes - Flow meter is accurate) Rating 3 (Yes - Flow meter not accurate) Rating 5 (No)	3	0.2	*RECOMMENDATIONS:* Replace Piping	*COST ESTIMATE* $ 9,000.00			
		Appropriate Piping Configuration: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper piping configuration for application. Risk of Critical Failure)	1	0.1					
		Piping Capacity: *Issues for Discussion:*	Rating 1 (Piping has sufficient capacity for current and projected demand conditions) Rating 2 (Piping has sufficient capacity for current demand conditions with minor surplus) Rating 3 (Piping has sufficient capacity) Rating 4 (Piping does not meet current demand condition) Rating 5 (Piping is critically undersized and likelihood of station backup is high)	1	0.4					
	Maintainability and Operability	**Sufficient Access to Perform O&M Activities Safely:** *Issues for Discussion:*	Rating 1 (Yes - No access restrictions) Rating 2 (Yes - Some minor access restrictions) Rating 3 (Yes - Access restrictions that cause minor alteration of work method) Rating 4 (No - Access restrictions cause significant alteration of work method) Rating 5 (No - Access restrictions prevent safe completion of O&M activities)	2	0.6					
		Isolation Valves Installed: *Issues for Discussion:*	Rating 1 (Yes) Rating 5 (No)	1	0.4					
	PHOTOGRAPHS	  								

Appendix E

Power Condition Assessment Forms

Project No.: 8400-001-00
Tag: **E_Service**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

ELECTRICAL SERVICE CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physcial Condition	CONDITION RATING: Fitness For Purpose	AGE: YEAR INSTALLED	AGE: EXPECTED SERVICE LIFE	AGE: REMAINING SERVICE LIFE
Equipment Tag: E_Service Description: Asset 14906 Fused Discconect	GENERAL	Location: Dry Well, Main Level Description: Asset 14906 Fused Discconect Phase: 3 Rated Voltage: 600 VAC Rated Current: 100 A		3.2	2.9	1995	40	16
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)		**4**
	Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.1			
		Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4			
		Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	1	0.1			
		Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.4			
	Fitness for Purpose	**Meets City Electical Design Guide:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	3	0.2			
		Standby Generator Needed & Present: *Issues for Discussion:*	Rating 1 (Yes / Not needed) Rating 3 (Needed / Portable Generator) Rating 5 (Needed / Not Available)	3	0.2			
		Is Main Breaker Present & Appropriate: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (Present, not appropriate) Rating 5 (Not Present)	5	0.05			
		Is Grounding System Present & Appropriate: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (Present, not appropriate) Rating 5 (Not Present)	3	0.1			
		Is Utility Service appropriate: (600V/3PH) *Issues for Discussion:*	Rating 1 (Yes) Rating 5 (No)	1	0.1			
		Has the Service Capactiy Been Reached? *Issues for Discussion:*	Requires review of service calculation. Rating 1 (Service < 85% capacity) Rating 3 (Service 85% - 99% capacity) Rating 5 (Service > 99% capacity	3	0.1			
		Equipment Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	3	0.25			

NOTES & COMMENTS:

Sevice enters the lift station over head from three pole mount transformers. It then enters into a 100A disconnect which then supplies power to a wall mount splitter. Main service equipment is showing signs of corrosion. Equipment is not rated for a classified location. City staff noted service is Delta configuration. No transfer switch is at the location for hooking up Portable Generator during power failure. Height restrictions would limit the station to remain with individual service components rather than an MCC. Same phylosophy could be used as Configuration C in the Electrical Design Guide.

Service does not meet Design Guide.Most notably no provisions for backup power. Table 3-2 the City would like back up power options based on a deemed Risk Level for the station. Portable generator requirements are needed. Capacity along with pump motor size and RPM were raised as a concern, as pumps run well after storms to keep up with demand. Exposed Ground and connection means show considerable corrosion. Ground cable appears to be FT-2 rated not FT-4. Ground is entered into disconnect using a L-16 fitting allowing corrosize gasses into the equipment.

RECOMMENDATIONS:	*COST ESTIMATE*
Complete a service upgrade once HVAC and Wetwell hatch concerns have been mitigated. Service upgrade to mimic City Design Guide Configuration C of 3.3.3 Bring service up to City Design Guide Standards. Further assessment of the grounding system. Rubber Tape, Penetrox to prevent further corrosion. Assess motor size to lift station requirements to keep up with demand.	$ 30,000.00

PHOTOGRAPHS

Project No.: 8400-001-00
Tag: **E_Starter_1**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

FVNR CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19
Asset ID:

Equipment Tag: E_Starter_1
Description: Asset 14914 (MS-L72)

GENERAL

Location:	Dry Well, Main Level
Description:	Asset 14914 (MS-L72)
Manufacturer:	Square D
Model:	CL 8538
Phase:	3
Rated Voltage:	600
Rated Horsepower:	10

CONDITION RATING				AGE		
Current Physcial Condition	Fitness For Purpose			YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
3.2	2.5			1995	40	16

Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)	4

Current Physical Condition

DATA		Rating	Weight
Equipment Visual Inspection: *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	1	0.1
Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4
Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	3	0.1
Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.4

Fitness for Purpose

DATA		Rating	Weight
Meets City Electical Design Standards: *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	3	0.25
Has the Breaker Capactiy been Reached? *Issues for Discussion:*	Review starts per hour vs. recommendation Rating 1 (< 80% rec. starts / hour) Rating 3 (80% - 95% rec. starts / hour) Rating 5 (>95% rec. starts / hour)	1	0.25
Equipment Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	3	0.5

NOTES & COMMENTS:

Equipment is not rated to be in the hazardous area it currently occupies. Multiple splice points and capped wire ends within starter leading to more potential fail points. Regular Fuse replacement required.

RECOMMENDATIONS:	*COST ESTIMATE*
Replace Starter as part of the service upgrade, following the HVAC improvements and provided the wetwell hatch concerns have been mitigated. Enclosure may be able to be salvaged dependent on how soon the corrosive atmosphere is corrected.	$ 2,000.00

PHOTOGRAPHS




Project No.: 8400-001-00
Tag: **E_Starter_2**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

FVNR CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physcial Condition	CONDITION RATING: Fitness For Purpose			AGE: YEAR INSTALLED	AGE: EXPECTED SERVICE LIFE	AGE: REMAINING SERVICE LIFE
Equipment Tag: E_Starter_2 Description: Asset 14915 (MS-L73)	GENERAL	Location:	Dry Well, Main Level	3.2	2.5			1995	40	16
		Description:	Asset 14915 (MS-L73)							
		Manufacturer:	Square D							
		Model:	PKZ 2 / 22 DIL M							
		Phase:	3							
		Rated Voltage:	600							
		Rated Horsepower:	20							

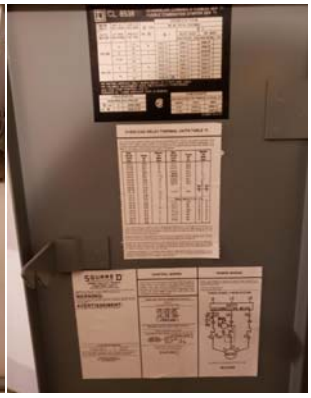
			Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)	
Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	1	0.1		4
	Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4		
	Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	3	0.1		
	Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.4		
Fitness for Purpose	**Meets City Electical Design Standards:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	3	0.25		
	Has the Breaker Capactiy been Reached? *Issues for Discussion:*	Review starts per hour vs. recommendation Rating 1 (< 80% rec. starts / hour) Rating 3 (80% - 95% rec. starts / hour) Rating 5 (>95% rec. starts / hour)	1	0.25		
	Equipment Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	3	0.5		

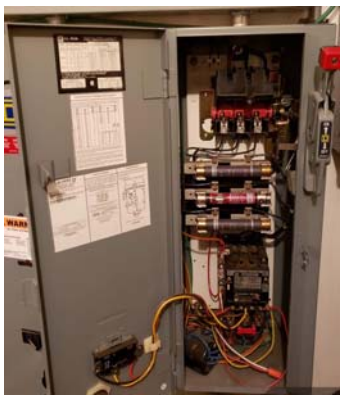
NOTES & COMMENTS:

Equipment is not rated for classified locations. Multiple splice points and capped wire ends within starter leading to more potential fail points. Regular Fuse replacement required.

RECOMMENDATIONS:	*COST ESTIMATE*
Replace Starter as part of the service upgrade, following the HVAC improvements and provided the wetwell hatch concerns have been mitigated. Enclosure may be able to be salvaged dependent on how soon the corrosive atmosphere is corrected.	$ 2,000.00

PHOTOGRAPHS

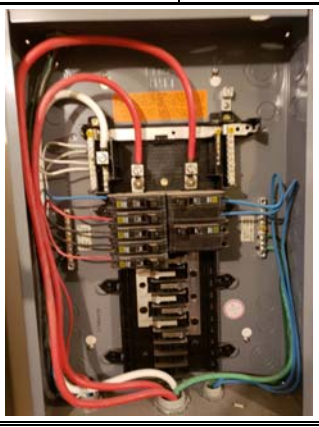




Project No.: 8400-001-00
Tag: **E_Dist_Panel**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

PANELBOARD CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physcial Condition	CONDITION RATING: Fitness For Purpose			AGE: YEAR INSTALLED	AGE: EXPECTED SERVICE LIFE	AGE: REMAINING SERVICE LIFE
Equipment Tag: E_Dist_Panel Description: Asset 14913 (PNL-L74)	GENERAL	Location:	Dry Well Main Level	3.1	1.5			1994	40	15
		Description:	Asset 14913 (PNL-L74)							
		Manufacturer:	Square D							
		Model:	QOC24UC							
		Phase:								
		Rated Voltage:								
		Rated Current:								
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**4**
	Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	1	0.1	*NOTES & COMMENTS:*				
		Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4	*Panelboard appears to be in "GOOD" condition. Assuming corrosive atmosphere concerns are dealt with in the near future there will be no need to replace the Panelboard.*				
		Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	2	0.1					
		Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.4	*RECOMMENDATIONS:*	*COST ESTIMATE*			
	Fitness for Purpose	**Meets City Electical Design Standards:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	1	0.25	Ensure corrosive atmosphere is corrected. Use anti Corrosion pucks to limit the amout of corrosion to take place in the mean-time				
		Has the Capactiy been Reached? *Issues for Discussion:*	Rating 1 (Panel < 70% Full) Rating 2 (Panel < 90% Full) Rating 3 (Panel > 90 Full or Loaded) Rating 4 (Panel Full but not Loaded) Rating 5 (Panel 100% Full or Loaded)	1	0.25					
		Equipment Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	2	0.5					
	PHOTOGRAPHS									

Project No.: 8400-001-00
Tag: **E_Motor_1**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

MOTOR CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19
Asset ID:

Equipment Tag: E_Motor_1
Description: Asset 14918

SECTION	ITEM	DATA		CONDITION RATING: Current Physcial Condition	CONDITION RATING: Fitness For Purpose	AGE: YEAR INSTALLED	AGE: EXPECTED SERVICE LIFE	AGE: REMAINING SERVICE LIFE
Equipment Tag: E_Motor_1 Description: Asset 14918	GENERAL	Location:		3.2	2.5	1995	25	1
		Description:	Asset 14918					
		Manufacturer:						
		Model:						
		Horsepower:						
		Rated Voltage:						
		Phase:						
		Rated Current:						
		RPM:						
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)		**4**
	Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	2	0.1			
		Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4			
		Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	0	0			
		Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.5			
	Fitness for Purpose	**Meets City Electical Design Standards:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	1	0.25			
		Has the Capactiy been Reached? *Issues for Discussion:*	Rating 1 (Below service factor) Rating 2 (Occasional within service factor) Rating 3 (Frequent within service factor) Rating 4 (Always Within Service Factor) Rating 5 (> Service Factor)	3	0.5			
		Equipment Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	3	0.25			

NOTES & COMMENTS:

Motor HP does not match the recent Arc flash study single line that was recently completed. Motor is not rated for a classified area. Motor appears to be in "Fair" condition. Concerns of motor size and RPM not being high enough. Cable feed is draped across floor which can lead to potential damage and splices. Peckerheads was not opened for visual inspection.

RECOMMENDATIONS:	*COST ESTIMATE*
Evaluate motor size and RPM requirements to fullfill the purpose of the Lift station. Supply negative pressure in order for regular elec equipment to be used. Install a proper raceway method to feed the peckerhead.	$ 500.00

PHOTOGRAPHS

Project No.: 8400-001-00
Tag: **E_Motor_2**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

MOTOR CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19
Asset ID:

Equipment Tag: E_Motor_2
Description: Asset 14923

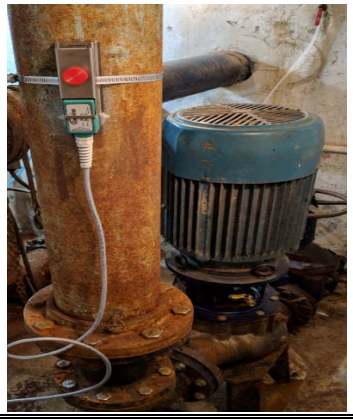
SECTION	ITEM	DATA		CONDITION RATING: Current Physcial Condition	CONDITION RATING: Fitness For Purpose	AGE: YEAR INSTALLED	AGE: EXPECTED SERVICE LIFE	AGE: REMAINING SERVICE LIFE
	GENERAL	Location:		3.3	2.5	1995	25	1
		Description:	Asset 14923					
		Manufacturer:						
		Model:						
		Horsepower:						
		Rated Voltage:						
		Phase:						
		Rated Current:						
		RPM:						
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)		**1**
	Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	3	0.1			
		Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4			
		Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	0	0			
		Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.5			
	Fitness for Purpose	**Meets City Electical Design Standards:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	1	0.25			
		Has the Capactiy been Reached? *Issues for Discussion:*	Rating 1 (Below service factor) Rating 2 (Occasional within service factor) Rating 3 (Frequent within service factor) Rating 4 (Always Within Service Factor) Rating 5 (> Service Factor)	3	0.5			
		Equipment Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	3	0.25			

NOTES & COMMENTS:

Motor HP does not match the recent Arc flash study single line that was recently completed. Motor is not rated for a classified area. Motor appear to be in "POOR" condition. Concerns of motor size and RPM not being high enough. Cable feed is draped across floor which can lead to potential damage and splices. Peckerhead was not opened for visual inspection.

RECOMMENDATIONS:	*COST ESTIMATE*
Evaluate motor size and RPM requirements to fullfill the purpose of the Lift station. Supply negative pressure in order for regular elec equipment to be used. Install a proper raceway method to feed the peckerhead.	$ 500.00

PHOTOGRAPHS



Project No.: 8400-001-00
Tag: **E_Motor_3**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

MOTOR CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19
Asset ID:

SECTION	ITEM	DATA		CONDITION RATING: Current Physcial Condition	CONDITION RATING: Fitness For Purpose	AGE: YEAR INSTALLED	AGE: EXPECTED SERVICE LIFE	AGE: REMAINING SERVICE LIFE
Equipment Tag: E_Motor_3 Description: Asset 14928	GENERAL	Location:	Dry Well Main Level	3.2	2.0	1995	25	1
		Description:	Asset 14928					
		Manufacturer:	Baldor					
		Model:	L1301					
		Horsepower:	1/3 H.P.					
		Rated Voltage:	115/208-230					
		Phase:	Single					
		Rated Current:	6.6/3.5-3.3 Amps					
		RPM:	1725					

			Rating	Weight	Recommended Frequency of Review: (In years, specify between 1-15)	4
Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	2	0.1	*NOTES & COMMENTS:* *Motor is not rated for classified areas.* *City Personel made mention that these are slowly being replaced with smaller compact units.*	
	Canadian Electrical Code Issues Identified: *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4		
	Wiring Terminations Visual Inspection: *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	0	0		
	Occurrences of Maintenance Issues: *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	2	0.5	*RECOMMENDATIONS:* Address HVAC and Wetwell hatch concerns to bring motor location to code. Replace to match other lift stations at end of life cycle, or as City sees fit.	*COST ESTIMATE*
Fitness for Purpose	**Meets City Electical Design Standards:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	1	0.25		
	Has the Capactiy been Reached? *Issues for Discussion:*	Rating 1 (Below service factor) Rating 2 (Occasional within service factor) Rating 3 (Frequent within service factor) Rating 4 (Always Within Service Factor) Rating 5 (> Service Factor)	2	0.5		
	Equipment Remaining Service Life: *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	3	0.25		

PHOTOGRAPHS

Project No.: 8400-001-00
Tag: **E_Transformer**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

TRANSFORMER CONDITION ASSESSMENT FORM

Assessor: R. Ofstie & D. Grant
Date: 18-Apr-19

Asset ID: 14916

SECTION	ITEM	DATA		CONDITION RATING: Current Physcial Condition	CONDITION RATING: Fitness For Purpose			AGE: YEAR INSTALLED	AGE: EXPECTED SERVICE LIFE	AGE: REMAINING SERVICE LIFE
Equipment Tag: E_Transformer Description:	GENERAL	Location: Description: Manufacturer: Model: Phase: Rated Voltage: Rated kVA:		2.6	2.6			1995	40	16
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**4**
	Current Physical Condition	**Equipment Visual Inspection:** *Issues for Discussion:*	Rating 1 (Like New) Rating 2 (Minor Surface Corrosion) Rating 3 (Surface & Internal Corrosion) Rating 4 (Severe Corrosion) Rating 5 (Safety Concern)	1	0.1	*NOTES & COMMENTS:* *Transformer appears to be in "GOOD" condition. Equipment is not rated for classified locations.*				
	Current Physical Condition	**Canadian Electrical Code Issues Identified:** *Issues for Discussion:*	Rating 1 (No issues) Rating 3 (Non compliant - current code) Rating 5 (Non compliant - legacy code)	5	0.4					
	Current Physical Condition	**Wiring Terminations Visual Inspection:** *Issues for Discussion:*	Rating 1 (Connections tight, labelled) Rating 2 (Missing Labels) Rating 3 (Loose / Disorganized wiring) Rating 4 (Inappropriate wiring) Rating 5 (Combination of above)	1	0.1					
	Current Physical Condition	**Occurrences of Maintenance Issues:** *Issues for Discussion:*	Rating 1 (None) Rating 2 (Intermittent) Rating 3 (Consistent but occasional) Rating 4 (Frequent) Rating 5 (Constant)	1	0.4	*RECOMMENDATIONS:* Address HVAC and Wetwell hatch concerns to bring transformer location to code.	*COST ESTIMATE*			
	Fitness for Purpose	**Meets City Electical Design Standards:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - current standards) Rating 5 (No - legacy standards)	1	0.2					
	Fitness for Purpose	**Has the Capactiy been Reached?** *Issues for Discussion:*	Rating 1 (<75%) Rating 2 (<85%) Rating 3 (<95%) Rating 4 (At capacity) Rating 5 (Above capacity)	3	0.4					
	Fitness for Purpose	**Equipment Remaining Service Life:** *Issues for Discussion:*	Rating 1 (> 90% lifecycle remain) Rating 2 (> 75% lifecycle remain) Rating 3 (> 50% lifecycle remain) Rating 4 (> 25% lifecycle remain) Rating 5 (obsolete)	3	0.4					
	PHOTOGRAPHS									

Appendix F

Force Main Condition Assessment Forms

Project No.: 8400-001-00
Tag: **FM_Piping**
Facility: St. Charles Lift Station
Assessment Page 1 of 1

FORCEMAIN PIPING CONDITION ASSESSMENT FORM

Assessor: Mark Baker
Date: 18-Apr-19

Asset ID: 0

Equipment Tag: FM_Piping
Description: Sanitary Force Main

SECTION	ITEM	DATA		CONDITION RATING: Current Physical Condition	Fitness For Purpose		3rd Party & Environmental Damage	AGE: YEAR INSTALLED	EXPECTED SERVICE LIFE	REMAINING SERVICE LIFE
	GENERAL	Location: Sansome Avenue and St. Charles Street Description: Sanitary Force Main Size: 150 mm Material: AC Service: Sewage Coating: N/A		3.4	1.0		1.0	1960	70	11
				Rating	**Weight**	Recommended Frequency of Review: (In years, specify between 1-15)				**10**
	Current Physical Condition	**Force Main Breaks or Leaks in the Past:** *Issues for Discussion:*	Rating 1 (Like New) Rating 3 (Minor Repairs) Rating 4 (Major Repairs) Rating 5 (Risk of Critical Failure)	3	0.6	*NOTES & COMMENTS:* *Force Main is nearing the end of its service life.* *Force main has sufficient capacity for the majority of flows from the station.*				
	Current Physical Condition	**Force Main Age:** *Issues for Discussion:*	Rating 1 (Less than 10 years old) Rating 2 (Less than 25 years old) Rating 3 (Greater than 25 years old) Rating 4 (Greater than 50 years old) Rating 5 (Greater than 75 years old)	4	0.4					
	Fitness for Purpose	**Compatibility with Pumps and Motors:** *Issues for Discussion:*	Rating 1 (Yes) Rating 3 (No - Station still functional) Rating 5 (No - Improper force main selection for application. Risk of Critical Failure)	1	1	*RECOMMENDATIONS:*	*COST*			
	3rd Party & Environmental Damage	**Force Main Attached to a Bridge:** *Issues for Discussion:*	Rating 1 (No) Rating 5 (Yes)	1	0.2					
	3rd Party & Environmental Damage	**Force Main Near Other Underground Utilities:** *Issues for Discussion:*	Rating 1 (No) Rating 3 (Yes - Minor nearby utilities) Rating 5 (Yes - Major nearby utilities)	1	0.3					
	3rd Party & Environmental Damage	**Force Main Under a River Crossing:** *Issues for Discussion:*	Rating 1 (No) Rating 3 (Yes - location of pipe not an issue) Rating 5 (Yes - location of pipe is an issue)	1	0.5					
	PHOTOGRAPHS									

Appendix G

Design Standards & Guidelines

Appendix G – Design Standards and Guidelines

The Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers and Ontario Ministry of the Environment, as stipulated in *Recommended Standards for Wastewater Facilities – 2014 and Design Guidelines for Sewage Works – 2008,* have established standards and guidelines for public sewage works such as gravity sewers, force mains, and sewage pumping stations. The following information summarizes the guidelines and best industry practices as they relate to the components of the sewage pumping facility.

Structures – Regulatory Requirements

Lift station structures should be designed to facilitate removing pumps, monitors, and other mechanical and electrical equipment. In areas where high groundwater conditions are expected, adequate provisions should be made for protection against buoyancy of the lift station structures. Lift station structures should be water tight, protected from physical damage from a 100-year flood, and should remain fully operational and accessible during a 25-year flood. Lift stations are to be designed as "Post-Disaster" buildings under the Manitoba Building Code.

Pumps – Regulatory Requirements

Lift stations shall be designed with multiple pump units, with provision for the peak wastewater design flows to be handled by the remaining pumps in the event of the largest pump being out of service. Pumps handling raw wastewater should be capable of passing particles of a minimum 75 mm in diameter. Minimum pump suction and discharge openings should be 100 mm in diameter. Each pump should have an individual intake with wet well and intake designed to avoid turbulence near the intake and prevent vortexing. In order to minimize hydraulic surges, lift stations should be designed to deliver as uniform a flow as practicable.

Valves – Regulatory Requirements

Suitable shut-off valves should be placed on the discharge lines of pumps. Check valves should be placed between the shut-off valve and the pump on the discharge line of each pump. Check valves should be suitable for the material being handled and shall be placed on the horizontal portion of the discharge piping with the exception of ball check valves, which may be placed in the vertical. Valves should be capable of withstanding normal operating pressure and water hammer. All valves should be operable from floor level and accessible for maintenance.

Wet Wells – Regulatory Requirements

Wet well sizing should take into consideration the design fill time and minimum pump cycle time. The effective volume of the wet well should be based on design average flow and is not to exceed a fill time of 30 minutes unless the facility is designed to provide flow equalization/storage. When selecting the minimum cycle time, the motor manufacturer's duty cycle recommendations should be utilized. Provisions should be made so that the fill time indicated is not exceeded for initial flows when the anticipated initial flow to the pumping station is less than the design average flow. Pump configurations within the wet well should be designed to avoid settling of solids. The wet well floor should have a minimum slope of 1:1 to the hopper bottom.

Flow Measurement – Regulatory Requirements

All lift stations should be provided with suitable devices for measuring wastewater flow. Large lift stations with peak design flow greater than 50 L/s should be provided with indicating, totalizing, and recording flow measurement devices. Elapsed time meters may be used for lift stations with peak design flow less than 50 L/s.

Electrical Equipment – Regulatory Requirements

Electrical systems and associated components (motors, lights, cable, switchboxes, control circuits, etc.) in lift station wet wells, or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapours are likely to occur in normal operation, should comply with the Canadian Electrical Code requirements for Zone 1 hazardous locations. Equipment located in wet wells should be suitable for use in corrosive conditions and meet the requirements under the Canadian Electrical Code for Category 2 corrosive environments. Electrical systems installed in lift station dry wells, or in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapours are not likely to occur in normal operation, should comply with the Canadian Electrical Code requirements for Zone 2 hazardous locations. Equipment located in dry wells should be suitable for use in corrosive conditions and meet the requirements under the Canadian Electrical Code for Category 1 corrosive environments. If a lift station dry well complies with the ventilation requirements set forth in the NFPA standard 820 to be an unclassified space, the electrical systems installed in dry wells may not be considered a Zone 2 hazardous location.

Alarm Systems – Regulatory Requirements

Alarm systems should be provided for lift stations. Alarms should be in place for cases of high and low liquid levels, power failure, sump pump failure, pump failure, unauthorized entry, or any cause of lift station fault. Lift station alarms should be telemetered to the personnel in charge of operating the lift station. In some cases, audio-visual alarm systems with a self-contained power supply may be installed in lieu of a telemetering system depending on location, station holding capacity, and inspection frequency.

Emergency Operation – Regulatory Requirements

Lift stations should be designed to operate in such a way that equipment failure may not result in the discharge of raw wastewater to any waters and to protect public health by preventing backup of wastewater and subsequent discharge to basements, streets, and other public and private property.

Ventilation – Regulatory Requirements

Ventilation systems shall be designed to function year round, including fresh air intake louvers and openings. To prevent subsequent blockages, screen openings should be sized to avoid build-up of frost during winter months. Ventilation of the wet well may be either continuous or intermittent. If continuous, a minimum of 12 complete air changes per hour is required. If intermittent, a minimum of 30 complete air changes per hour during the period of occupancy is required. Fresh air should be forced into wet wells by mechanical means at a point about 30 cm above the expected high liquid level, with provision for emergency automatic blow-by to elsewhere in the wet well, should the fresh air outlet become submerged. Provision should be made in the lift station system design to verify that the ventilation fan is operational and the air change capacity is achieved.

Ventilation of the dry well may be either continuous or intermittent. If continuous, a minimum of 6 complete air changes per hour are required. If intermittent, a minimum of 30 complete air changes per hour during the period of occupancy are required. Positive pressure ventilation is recommended and the system is to avoid dispensing contaminants throughout other areas of the lift station.

Provision for heating of intake air is recommended. Switches for the operation of ventilation equipment are to be plainly identified and located within arm's reach of the lift station entry way. All intermittently operated ventilation equipment should be interconnected with the lighting system.

Force main – Regulatory Requirements

The minimum pipe diameter for a force main should not be less than 100 mm. Velocities less than 0.6 m/sec (2 ft/sec) and greater than 1.6 m/sec (5.2 ft/sec) are not recommended. Above 3.0 m/sec pipe scouring can damage the walls of the pipe. Below 0.6 m/sec solid particles can separate from the wastewater and settle to the bottom of the pipe, which can obstruct the pipe flow over time. Total retention time in a force main should be kept under 4 hours to avoid anaerobic fermentation and the resultant production of odorous, hazardous, and corrosive gases.

Sewer – Regulatory Requirements

It is recommended that no gravity sewer conveying raw sewage should be less than 200 mm in diameter. Sanitary sewers should be designed and constructed with such slopes to give a mean velocity of not less than 0.6 m/s (2 fps) during average flow conditions with due consideration given to actual depth of sewage flowing in the pipe. Slopes slightly less than those required for 0.6 m/s (2 fps) may be considered if the depth of flow will be 0.3 of the diameter or greater for design average flow, and provisions can be made for frequent cleaning. Manholes should be installed at the end of each line and at all changes in grade, size, or alignment. Manhole spacing should not exceed 120 m for sewers 380 mm (15 inches) in diameter or less. The sewer shall be installed at no less than 600 mm below a water line if installed in the same trench and the horizontal separation distance is a minimum of 300 mm. Best industry practices are to maintain a minimum of 3 meters separation distance between water and sewer lines and a separation distance of 300 mm when crossing with the water line above.

Design Standards & Guidelines

- MPE prepared this assessment in accordance to the following standards and guidelines as a minimum:
- City of Winnipeg Design and Development Standards Manual, 2017
- City of Winnipeg Sewage Works Control Bylaw (Bylaw No. 5115)
- City of Winnipeg Standard Construction Specifications and Drawings, Roadways, Water, and Sewer
- The Waterworks and Sewage Works Regulations, 2015
- The Environmental Management and Protection Act, 2002
- Water Security Agency, Sewage Works Design Standard (EPB 503), Nov. 15, 2012
- AWWA M11 – Steel Pipe – A Guide for Design and Installation
- AWWA M23 – PVC Pipe: Design and Installation
- AWWA M55 – PE Pipe: Design and Installation
- ANSI/HI – 1.3, 1.4, 1.6, 9.1-9.5 Standards for Centrifugal Pumps
- ANSI/HI – 9.6.4 Rotodynamic Pumps for Vibration Measurements & Allowable Values
- ANSI/HI – 9.6.5 Rotodynamic Pumps – Guideline for Condition Monitoring
- ANSI/HI – 9.6.6 Rotodynamic Pumps for Pump Piping

- ANSI/HI – 9.8 Pump Intake Design
- ANSI/HI – 11.6-2012 Rotodynamic Submersible Pumps: for Hydraulic Performance
- ASME/ANSI B16.5 – 2013
- ANSI – Applicable Standards
- ASTM – Applicable Standards
- AMSE – Applicable Standards
- AWWA – Applicable Standards
- Saskatchewan Plumbing and Drainage Regulations
- Canadian Standards Association (CSA)
- National Sanitation Foundation (NSF)
- Canadian Electrical Code (CEC)
- Institute of Electrical and Electronic Engineers (IEEE)
- Electrical and Electronic Equipment Manufacturers Association of Canada (EEMAC)
- National Building Code of Canada
- National Plumbing Code of Canada
- Canadian Standards Association (CSA) Natural Gas and Propane Installation Code CSA B149.1
- American Society of Heating, Refrigeration & Air Conditioning Engineers (ASHRAE)
- ACI, Requirements for Assessment, Repair, and Rehab of Existing Concrete Structures (ACI 562M-16)
- ACI, Metric Building Code Requirements for Structural Concrete and Commentary (ACI 318M-14)
- ACI, Code Requirements for Environmental Engineering Concrete Structures (ACI 350-06)
- Process Industry Practices, Fixed Ladders and Cages (PIP STF05501)
- National Fire Code of Canada
- NFPA 820
- The Uniform Building & Accessibility Standards Regulations of Saskatchewan
- The Occupational Health and Safety Act