

APPENDIX E
COMMISSIONING PLAN



**SEWPCC PRIMARY CLARIFIERS
TRAVELLING BRIDGE REFURBISHMENT
COMMISSIONING PLAN
S1074-00DD-PLA-0002**

FINAL

KGS Group 18-0107-007
August 2018

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1.0 COMMISSIONING PLAN OVERVIEW

The South End Sewage Treatment Plant (SEWPCC) is the second largest of the three (3) sewage treatment plants servicing the City. The SEWPCC is located at 100 Ed Spencer Drive in Winnipeg, Manitoba. It has three (3) existing rectangular clarifiers that are used to provide for the initial primary treatment of the wastewater after grit removal and screening. Each primary clarifier generally consists of a rectangular concrete tank equipped with a travelling bridge mechanism to collect the sludge at the bottom of the tanks as well as the scum that floats at the surface. The three tanks are located to the west of the existing grit building. Each travelling bridge has a reversing motor mounted on the bridge for moving the unit back and forth in an east-west direction. Each bridge mechanism is controlled from a local control panel mounted directly on the travelling bridge.

Plant operations staff have expressed concern over the number of travelling bridge components that are failing. The local control panels were installed in 1992 and require significant ongoing maintenance. Electrical and control works will be done to all three clarifiers. Minor weld repairs will be required on the no.3 bridge with touch-up painting on bridges no.1 and 2. Mechanical works will be required on the no.3 bridge drive system only. This Commissioning Plan provides details on how the bridges and their associated equipment will be brought on-line and verified while maintaining plant operations.

1.1 PARTICIPANTS

Commissioning for the refurbished bridges will require the participation of the following organizations to verify the performance of the equipment and systems:

1. General contractor and any applicable sub-contractors.
2. Equipment manufacturers including Ovivo
3. Engineering consultant – KGS Group.
4. Client – City of Winnipeg.

1.2 ROLES AND RESPONSIBILITIES

KGS will coordinate overall commissioning activities. KGS will provide personnel as illustrated in Table 1 below.

**TABLE 1
 ROLES AND RESPONSIBILITIES**

Item	Task Description	Responsibility		
		Company	Department (If Applicable)	Individual (If Applicable)
1	Safely perform all pre-commissioning, commissioning and performance verification activities.	Contractor		
2	Safely operate the equipment as required to perform commissioning activities	Contractor		
3	Document equipment and control system settings.	Contractor		
4	Provide operations and maintenance manuals.	Contractor		
5	Provide as-built drawings.	Contractor		
6	Schedule and coordinate commissioning works.	KGS	PM	Rudy D.
7	Prepare agenda and record minutes of commissioning meetings.	KGS	PM	Rudy D.
8	Track deficiencies, record corrective measures	KGS	PM	Rudy D.
9	Supply commissioning record sheets, test forms, and other documentation.	KGS	MECH ELEC	Colburn H. Dustin W.
10	Witness the PLC and HMI FAT's.	KGS City	ELEC	Dustin W.
11	Witness 33% of the pre-commissioning tests.	KGS	ELEC	Dustin W.
12	Review and approve commissioning handover package.	KGS	MECH ELEC	Colburn H. Dustin W.
13	Start-up and shut down the clarifiers as required for the commissioning work	City		
14	Apply and remove safety lockouts as required.	City		
15	Verify existing DSC interface to new PLC	City		
16	Monitor alarms during performance verification.	City		

1.3 SCHEDULE

The anticipated commissioning schedule will occur as described in the most recent revision of the project schedule, see Appendix A for a project schedule that is trimmed to show only commissioning related tasks.

Pre-commissioning and start-up tasks will be started prior to the completion of the refurbishment in order to allow for the minimum amount of down time for the clarifier. After the completion of

construction there is a three working day period of time to allow for commissioning, training, and performance verification. The clarifier will be in full operation for the duration of the performance verification, and so training to operate the system controls will be required beforehand. The City has indicated that 2 days should be allowed for performance verification before proceeding with the shutdown of the next clarifier.

2.0 COMMISSIONING SPECIFICATIONS

Specifications for the commissioning process provide information for the start-up, testing, operation and acceptance criteria for the refurbished bridges. The commissioning specification includes the following:

- Descriptions of start-up, pre-commissioning, commissioning, and performance verification activities.
- List of the applicable checklists and test records
- Requirements for the training of the City plant operations staff
- Requirements for the operations and maintenance documents

The general commissioning specifications applicable to the refurbishment works include the following:

1. The Contractor shall submit completed testing and field commissioning record sheets on which the results of the various checks and tests shall be recorded, dated and approved by the OEM and/or installation contractor and KGS. Commissioning inspection and testing record sheets are contained in Appendix B.1 (electrical and control systems) and B.2 (mechanical).
2. The Contractor shall advise KGS and the City in writing when the work may be inspected before proceeding with the next commissioning task. The equipment and systems shall not be started before the approval of KGS has been obtained.
3. The Contractor is responsible for providing all necessary tools, materials, and equipment for conducting the required tests.
4. Any defects which become evident during commissioning shall be immediately corrected at the Contractor's expense and the test repeated until the work is proven satisfactory.
5. Testing, at a minimum, shall prove the following:
 - a. All clearances and alignments are in order.
 - b. Lubrication is adequate.
 - c. Control devices operate correctly and satisfactorily.
 - d. All circuits, controls and interlock sequences of operation are correct.
 - e. All protective and indicating devices operate satisfactorily.
 - f. Motor running currents under no load (decoupled motor) and full load are within acceptable ranges.

6. The Contractor is responsible for submitting the Operation and Maintenance (O&M) Manuals in accordance with the technical specifications.
7. Upon total completion of the project the final hand-over package shall be submitted by the contractor to KGS. It shall include all as-built drawings, installation records, and commissioning records.

The commissioning tasks are broken up by discipline. For each of the tasks outlined below, detailed procedure and record sheets will be provided or developed to document the commissioning of the travelling bridges. KGS Group will monitor the commissioning activities as specified in Section 2.0; and upon satisfactory completion of the commissioning, will review the documentation provided by the Contractor. The Contractor shall be responsible for the commissioning work under the direction of the Contract Administrator.

2.1 MECHANICAL

Because there are no mechanical works planned for clarifiers 1 and 2, the mechanical commissioning tasks below apply only to clarifier 3.

Pre-commissioning:

1. Verify that all steps listed in the Inspection and Test Plan documents in the mechanical portion of the technical specification have been fully signed off and completed.
2. Mark or tag any part that was installed, aligned, and/or torqued during the work to confirm that each part has been installed, aligned, or torqued adequately.
3. Carry out a follow up check on all equipment of the tags and marks to verify that no parts or pieces are incompletely installed (ie no loose bolts etc).

Commissioning:

1. Test run the bridge collector along the full length of the rails without the scraper arm assembly attached and with the clarifier empty. The unit should travel smoothly at the design speed (see drawing L-32917). Compare the motor operating current to the current listed in the Westinghouse bridge drive motor datasheet (refer to the Dorr-Oliver operations and maintenance manual). Current in excess of this value indicates the presence of excess friction or binding acting on the drive system. Record values in mechanical checklist is Appendix B.2.
2. Test run the bridge collector with the scraper arm assembly attached and with the clarifier empty. Confirm the same minimum performance requirements stated in item 1.

3. Test run the bridge collector with the scraper arm assembly attached and with the clarifier full. Confirm the same minimum performance requirements stated in item 1.

Performance verification:

1. Visually inspect the bridge daily during regular operation until turned over to the City for use. Report any defects.
2. Complete form CD-PM-TO-16 Certificate of Equipment Satisfactory Performance Form 103 located in specification 010001 – City Supplied Equipment and labelled “Mechanical”.
3. Complete form CD-PM-TO-17 Certificate of Satisfactory Process Performance Form 104 located in specification 010001 – City Supplied Equipment and labelled “Mechanical”.

Refer to Appendix B.2 for relevant City of Winnipeg Mechanical Checklists to be employed during commissioning. Any forms not provided that are necessary to show completion of the tasks described shall be developed by the contractor in an organized fashion, in a computer generated format.

2.2 ELECTRICAL

Pre-commissioning:

1. Verify that all motor starters operate as required in both automatic and manual modes.
2. Verify that all power feeders are installed and that the breakers are operational.

Commissioning tasks:

1. Verify the new power supply connection to the PLC and Remote I/O control panels.

Performance verification:

1. Verify the voltage and current monitoring and recording (logging) of the bridge drive equipment under various operating scenarios.

2.3 AUTOMATION

Pre-commissioning:

1. Perform fibre-optic cable testing as follows:
 - a. Perform cable length measurement, fiber fracture inspection and construction defect inspection using an optical time domain reflectometer.
 - b. Perform connector and splice integrity test using an optical time domain reflectometer.
 - c. Perform cable attenuation loss measurement with an optical power loss test set.
 - d. Perform connector and splice attenuation loss measurement from both ends of the optical cable with an optical power loss test set.
2. Remote I/O panel pre-commissioning includes:
 - a. Factory Acceptance Testing (FAT's) for all panel internal wiring, and the Remote I/O.
 - b. Loop checks to all field signals from the existing DCS to the PLC.
3. PLC panel pre-commissioning includes:
 - a. Factory Acceptance Testing (FAT's) for all panel internal wiring, the PLC and the HMI.
 - b. Loop checks to all field device signals to the PLC.
 - c. Verify the PLC program operations.
 - d. Verify communications between the PLC and the HMI.
 - e. Verify HMI operations.
 - f. Verify all signals and alarms on the HMI are correct.
 - g. Verify communications to and from the plant DCS system.
4. Re-verify that all signals and alarms on the plant DCS system indicate correctly.

Commissioning tasks:

1. Witness 33% of start-up of PLC and HMI systems. Any start-up deficiencies discovered will be rectified by the Contractor.
2. Confirm PLC operation with the following instrumentation:
 - a. Bridge Reversing Motor
 - b. Hoist Mechanism Reversing Motor
 - c. Travel Limit Switches
3. HMI operation and alarms.
4. Operation of communications with the plant DCS through the fibre optic communication link.

5. Operation of the entire automation system under various conditions.
6. Check plant DCS system operation and alarms to ensure all indications and alarms appear and are displayed correctly.

Performance verification:

1. City of Winnipeg to monitor the Primary Clarifier Travelling Bridges including all alarms.
4. Complete form CD-PM-TO-16 Certificate of Equipment Satisfactory Performance Form 103 located in specification 010001 – City Supplied Equipment and labelled “Electrical”.
2. Complete form CD-PM-TO-17 Certificate of Satisfactory Process Performance Form 104 located in specification 010001 – City Supplied Equipment and labelled “Electrical”.

Refer to Appendix B.1 for relevant City of Winnipeg Electrical and Instrumentation Checklists to be employed during commissioning. Any forms not provided that are necessary to show completion of the tasks described shall be developed by the contractor in an organized fashion, in a computer generated format.

3.0 PROJECT TRAINING PLAN

The objectives of the training are to provide City personnel with the following information:

1. How to operate the new control systems safely, and reliably.
2. Proper preventative maintenance practices along with diagnosis and trouble-shooting information.

For the training sessions, KGS will provide a description of the new systems with instruction on the design philosophy, criteria and intent. KGS is responsible for the coordination, quality assurance, overall packaging and presentation of two one (1) hour classroom sessions to provide training to two groups of City personnel.

KGS foresees providing the training for the following activities:

- KGS personnel to provide training on the operation and maintenance for the bridge electrical and automation systems complete with a demonstration.

The Contractor and any required certified factory-trained manufacturers' personnel will provide specific instruction on the start-up, operation and shut-down of their equipment with emphasis on the components, control features, servicing and maintenance. Specifically, training for the operation and maintenance of the Automation System including the PLC and the HMI is required. The Contractor shall provide instruction on the operation of the PLC and HMI system.

The City of Winnipeg is responsible for providing appropriate personnel to participate in the training for the operation and maintenance of the facility.

3.1 SESSION CONTENT

Although KGS Group is responsible for the overall training package, the individual equipment instructors will be responsible for the content and quality of their respective sections. In general, the training session content is to include:

1. A review of the system.
2. The functional requirements of the system.

3. A review of the system layout, the equipment, controls and emergency shut off.
4. Equipment and system start-up, operation, monitoring, servicing (including troubleshooting diagnosis), maintenance and shut-down procedures.
5. System operating sequences, including step-by-step directions for starting, operating and shutting down applicable switches and control settings.
6. A review of the O&M Manual documentation.

All training materials are to be in an acceptable digital format to the City that permits future training procedures that provide the same degree of detail. Final review and approval of all training manuals and materials is required by the City of Winnipeg prior to the training sessions. Training materials in general will include the following:

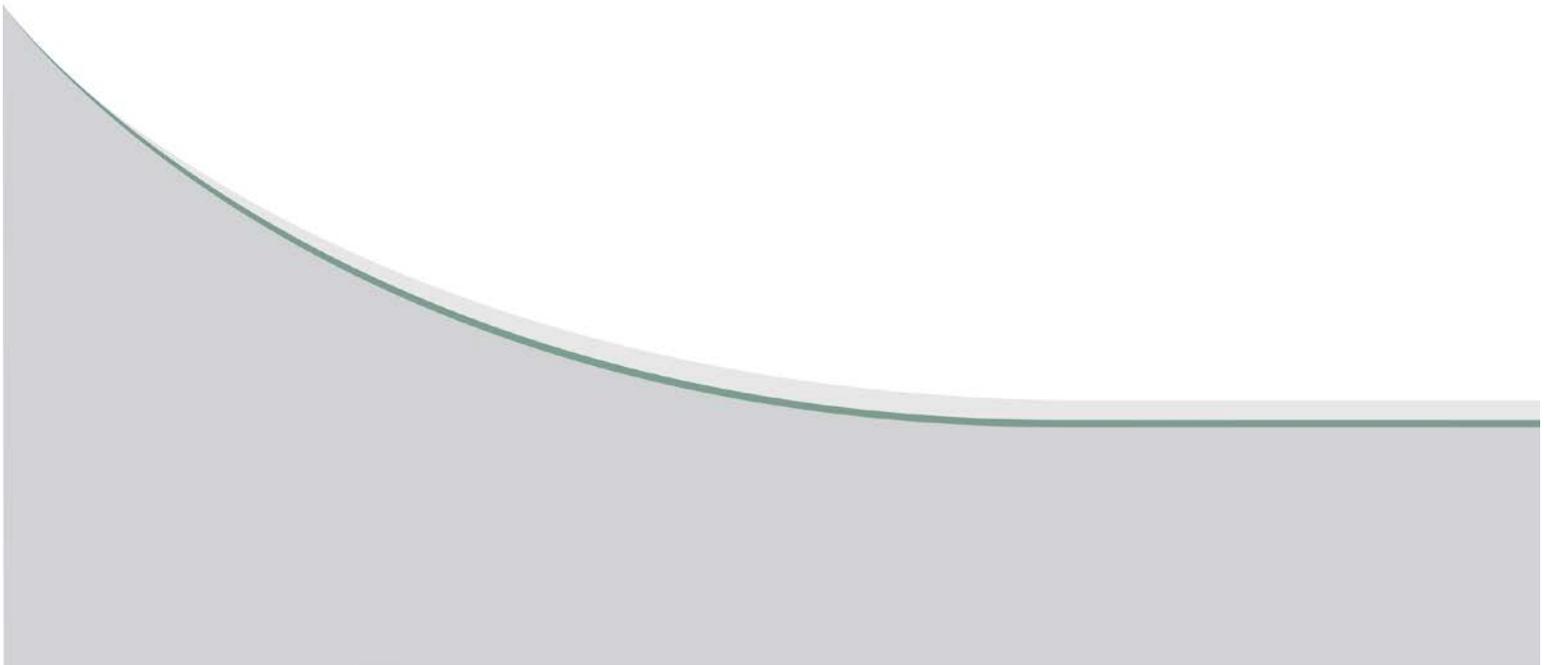
1. "As-Built" contract documents.
2. Operating Manuals.
3. Maintenance Manuals.
4. Shop Drawings.
5. Product Information (PI) sheets.
6. Supplemental training materials like presentations, training videos and/or equipment models.
7. Video recording of training sessions.

4.0 STATEMENT OF LIMITATIONS AND CONDITIONS

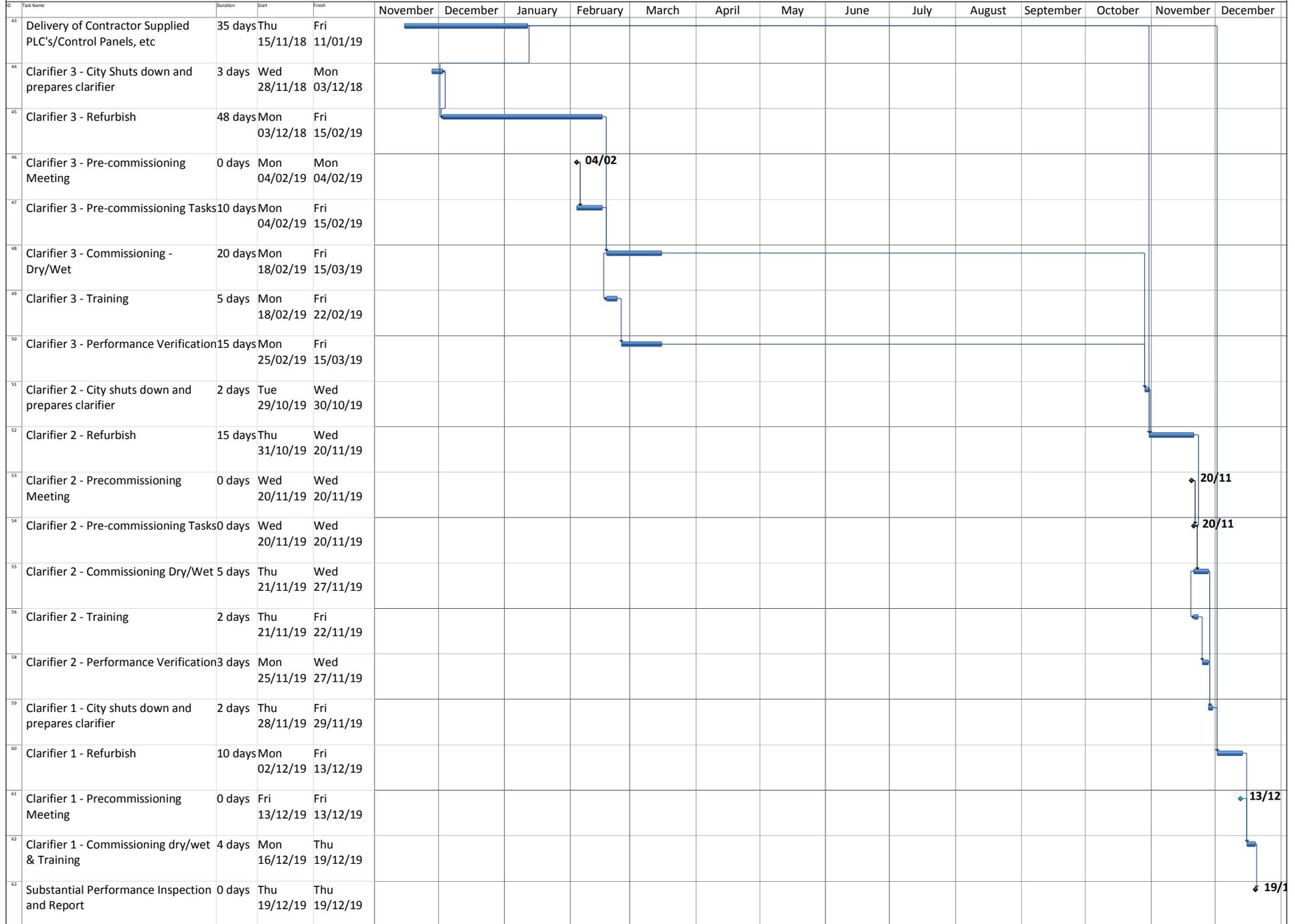
4.1 THIRD PARTY USE OF REPORT

This report has been prepared for the City of Winnipeg (City) and their Contractors and/or potential bidders for the SEWPCC Primary Clarifiers Travelling Bridges Refurbishment project to whom this report has been addressed and use by any other party of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

APPENDIX A
TRIMMED PROJECT SCHEDULE



SEWPCC - PRIMARY CLARIFIER 1-3 UPGRADE PROJECT - COMMISSIONING



APPENDIX B.1

CITY OF WINNIPEG ELECTRICAL AND INSTRUMENTATION COMMISSIONING CHECKLISTS

	INSPECTION FORM AUTOMATION – CONTROL CONDUCTORS		Page 1 of 1
			ID:
Project	Facility:	Project Name:	
	Area :	Bid Opportunity:	

Cable/Conduit Data	Source:		Dest.:	
	Installation: <input type="checkbox"/> Cable <input type="checkbox"/> Cable Tray <input type="checkbox"/> Strapped		<input type="checkbox"/> Conduit <input type="checkbox"/> EMT <input type="checkbox"/> Rigid Steel	
	<input type="checkbox"/> Direct Buried		<input type="checkbox"/> Alum. <input type="checkbox"/> PVC	
No. of Conductors:		Size:	AWG	Type:
				Rated Voltage: V

Visual Inspection	Cable Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		Enclosure Entry Acceptable: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Wire tags installed: <input type="checkbox"/> Yes <input type="checkbox"/> No		Conduit / Cable Supported Appropriately: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Comments:			

Insulation Resistance Test	Test Voltage: V		Ambient Temperature: °C		All conductors not under test grounded for each reading: <input type="checkbox"/> Yes <input type="checkbox"/> No				
	#	ID	MΩ	#	ID	MΩ	#	ID	MΩ
	1			19			37		
	2			20			38		
	3			21			39		
	4			22			40		
	5			23			41		
	6			24			42		
	7			25			43		
	8			26			44		
	9			27			45		
	10			28			46		
	11			29			47		
	12			30			48		
	13			31			49		
	14			32			50		
	15			33			51		
	16			34			52		
	17			35			53		
	18			36			54		
1. Utilize 1000VDC Test Voltage for 600V rated cables, 500VDC for cables rated <= 300V. 2. Utilize a single form for each cable / conduit. 3. Disconnect both ends of wiring prior to tests. 4. Test each conductor to ground. All conductors not under test must be grounded during each test. 5. Each reading must not be less than 22 MΩ or significantly less than comparable conductors.									
Comments:									
Test Summary: <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Failed									

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				

	INSPECTION FORM AUTOMATION – TWISTED SHIELDED PAIRS		Page 1 of 2
			Cable ID:
Project	Facility:		Project Name:
	Area :		Bid Opportunity:

Cable/Conduit Data	Source:		Dest.:	
	Installation: <input type="checkbox"/> Cable <input type="checkbox"/> Cable Tray <input type="checkbox"/> Direct Buried <input type="checkbox"/> Conduit <input type="checkbox"/> Other:		<input type="checkbox"/> EMT <input type="checkbox"/> Alum.	
	<input type="checkbox"/> Strapped		<input type="checkbox"/> Rigid Steel <input type="checkbox"/> PVC	
No. of Pairs:		Size:	AWG	Type:
				Rated Voltage: V

Visual Inspection	Cable Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		Enclosure Entry Acceptable: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Wire tags installed: <input type="checkbox"/> Yes <input type="checkbox"/> No		Conduit / Cable Supported Appropriately: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Comments:			

Insulation Resistance Test	Test Voltage: V		Ambient Temperature: °C		All conductors not under test grounded for each reading: <input type="checkbox"/> Yes <input type="checkbox"/> No					
	Pr	ID	Cond. 1 (+) to Gnd (MΩ)	Cond. 2 (-) to Gnd (MΩ)	Shield to Gnd (MΩ)	Pr	ID	Cond. 1 (+) to Gnd (MΩ)	Cond. 2 (-) to Gnd (MΩ)	Shield to Gnd (MΩ)
	1					13				
	2					14				
	3					15				
	4					16				
	5					17				
	6					18				
	7					19				
	8					20				
	9					21				
	10					22				
	11					23				
12					24					
1. Utilize 1000VDC Test Voltage for 600V rated cables, 500VDC for cables rated <= 300V. 2. Utilize a single form for each cable / conduit. 3. Disconnect both ends of wiring prior to tests. 4. Test each conductor to ground. All conductors and shields not under test must be grounded during each test. 5. Each reading must not be less than 22 MΩ or significantly less than comparable conductors.										
Comments:										
Test Summary: <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Failed										



**INSPECTION FORM
AUTOMATION – TWISTED SHIELDED PAIRS**

ID:

Continuity Test	Pr	ID	Cond. 1 (+) to Cond. 2 (-) (mΩ)	Cond. 1 (+) to Shield (mΩ)	Pr	ID	Cond. 1 (+) to Cond. 2 (-) (mΩ)	Cond. 1 (+) to Shield (mΩ)
	1				13			
	2				14			
	3				15			
	4				16			
	5				17			
	6				18			
	7				19			
	8				20			
	9				21			
	10				22			
	11				23			
	12				24			
<i>1. Record resistance from one end for each connection shown, which shall be made at the other end of the cable.</i>								
Comments:								
Test Summary: <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Failed								

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				

Project	Facility:	Project Name:
	Area :	Bid Opportunity:

Cable Data	Source:		Dest. / Load:	
	Manufacturer:		Type:	Conductor: <input type="checkbox"/> Copper <input type="checkbox"/> Aluminum
	No. of Conductors:	Size: <input type="checkbox"/> AWG <input type="checkbox"/> MCM	Length: m	<input type="checkbox"/> Measured <input type="checkbox"/> Previous Data <input type="checkbox"/> Jacket Markings <input type="checkbox"/> TDR
	Rated Voltage: V	Operating Voltage: V	Date Installed:	
	Installation: <input type="checkbox"/> Cable Tray <input type="checkbox"/> EMT <input type="checkbox"/> Alum. Conduit <input type="checkbox"/> Direct Buried	<input type="checkbox"/> Strapped <input type="checkbox"/> Steel Conduit <input type="checkbox"/> PVC Conduit <input type="checkbox"/> Underground Duct	Other:	

Visual Inspection	Physical Damage on Exposed Ends: <input type="checkbox"/> Yes <input type="checkbox"/> No	Cable Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Visual Signs of Overheating: <input type="checkbox"/> Yes <input type="checkbox"/> No	Cable Supported Appropriately: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Bend Radius Acceptable: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:

Insulation Resistance Test	Test Preparation: <input type="checkbox"/> Disconnected <input type="checkbox"/> Connected with Source Isolated	Source: <input type="checkbox"/> Disconnected <input type="checkbox"/> Connected with Load Isolated	Cable Dest. / Load: <input type="checkbox"/> Disconnected <input type="checkbox"/> Connected with Load Isolated	Note: Approval of City's Representative is required, prior to leaving cables connected during the test.	
	Cable Temperature: °C		Temperature Correction Factor for 20°C:	Ground all conductors not under test for each reading.	
	Test Voltage	Insulation Resistance (MΩ)			Test Summary <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed
		A-GND	B-GND	C-GND	
	V	Reading			
	Corrected to 20°C				
Utilize 1000VDC Test Voltage for 600V rated cables, 500VDC for cables rated <= 300V.					
Comments:					

Connection Resistance	Note: Torque check required for all cables. Connection Resistance Test required for cables 4/0 AWG or larger.					
	Termination	Connection Resistance (μΩ) - As Left				Torque Check
		A	B	C	N	
	Source					<input type="checkbox"/> OK
	Dest. / Load					<input type="checkbox"/> OK
Comments:						

Final Analysis	Cable Returned to Service: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Monitoring / Further Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				



**INSPECTION FORM
GROUNDING/BONDING CONNECTION RESISTANCE**

Area:

Project	Facility:	Project Name:
	Area :	Bid Opportunity:

Resistance Checks (Ductor Test)	Point A	Point B	Resistance (mΩ)	Acceptable
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
	Comments:			



**INSPECTION FORM
GROUNDING/BONDING CONNECTION RESISTANCE**

ID:

Resistance Checks (Ductor Test)	Point A	Point B	Resistance (mΩ)	Acceptable
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
				<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Inconclusive
	Comments:			

Final Analysis	Monitoring / Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				

Note: The person performing the check is responsible for ensuring that the data is transcribed from the handwritten form correctly, and that the analysis results are correct.



INSTRUMENTATION SWITCH CHECKLIST

Project

Facility:	Project Name:
Area :	Bid Opportunity:

Instrument

Tag:	Description:	
Manufacturer:	Model:	Serial Number:

Inspection Checklist

No.	Item to be Inspected	Comments	Pass (P/F)
1.	Instrument type and class per P&ID and specification		
2.	Instrument tag(s) installed and correct		
3.	Installation of sensor complete and correct		
4.	Block and drain valves		
5.	Pneumatic / hydraulic tubing leak tested		
6.	Heat tracing / insulation / instrument housing		
7.	Wiring correct		
8.	Drawings marked up as-built		
9.	HMI Graphic symbol and tag correct		

State Checklist

State	State Desc	PLC Input	Local HMI	SCADA	Alarm	Pass (P/F)
0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off <input type="checkbox"/> N/A	
1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off <input type="checkbox"/> N/A	

Calibration

Transition	Setpoint Trip Point (incl. units)	Actual Trip Point (incl. units)	Setpoint Time Delay	Actual Time Delay	Pass (P/F)
0 → 1					
1 → 0					

Comments:

	Company	Name	Signature	Date (yyyy/mm/dd)
Tested By				
Witnessed By				



INSPECTION FORM INTELLIGENT OVERLOAD

Page 1 of 2

ID:

Project	Facility:	Project Name:
	Area :	Bid Opportunity:

O/L Data	Location:	Cell #:
	Manufacturer:	Model:

Visual Inspection / Cleaning	General Condition: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Cleanliness (as found) <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Unit Cleaned: <input type="checkbox"/> Yes
	Connections (as found) <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Connections Torqued: <input type="checkbox"/> Yes

Communication Settings	Static IP Address:	Subnet Mask
	Gateway:	Protocol:
	MAC Address:	

Test Meter	Manufacturer:	Model:
	Calibration Date:	Meter calibration must be within one year, unless otherwise specified.

CTs	Type: <input type="checkbox"/> Internal to O/L <input type="checkbox"/> External	External CT Ratio:
	External Ground CT: <input type="checkbox"/> Yes <input type="checkbox"/> No	Ground CT Ratio:



INSPECTION FORM INTELLIGENT OVERLOAD

ID:

Verify accuracy of Intelligent O/L Measurements with the use of software via the communication network.									
Accuracy	Current	Nominal Test Value (A)	Phase	Calibrated Meter Measurement (A)	Intelligent O/L Measurement (A)	Difference (A)	Error (%)	Acceptable (See Specs)	
		0	A						<input type="checkbox"/> Yes <input type="checkbox"/> No
			B						<input type="checkbox"/> Yes <input type="checkbox"/> No
			C						<input type="checkbox"/> Yes <input type="checkbox"/> No
			A						<input type="checkbox"/> Yes <input type="checkbox"/> No
			B						<input type="checkbox"/> Yes <input type="checkbox"/> No
	C							<input type="checkbox"/> Yes <input type="checkbox"/> No	
	Measurements Applicable To: <input type="checkbox"/> As-Found <input type="checkbox"/> As-Left May check both boxes if applicable.								
	Unit Calibration Adjusted: <input type="checkbox"/> Yes <input type="checkbox"/> No If calibration was adjusted, complete two forms, one for as-found, the other for as-left after calibration.								

Final Analysis	Returned to Service:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Monitoring / Further Inspection Required:	<input type="checkbox"/> Yes <input type="checkbox"/> No	
	Repair / Replacement Required:	<input type="checkbox"/> Yes <input type="checkbox"/> No	

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				

Note: The person performing the check is responsible for ensuring that the data is transcribed from the handwritten form correctly, and that the analysis results are correct.

	INSPECTION FORM MOTOR STARTER, FVNR, BASIC		Page 1 of 1
			ID:
Project	Facility:	Project Name:	
	Area :	Bid Opportunity:	

Starter Data	Load:	Starter Location:		Cell #:	
	Manufacturer:	Type:	Size:	Rated Voltage: V	
	Circuit Protection:	<input type="checkbox"/> Fused Disc.	Fuse Size: A		
		<input type="checkbox"/> Breaker <input type="checkbox"/> MCP	Rating: A	Inst. Setting: A	Manufacturer:
	Overload Protection:	<input type="checkbox"/> Thermal <input type="checkbox"/> Electronic	Class: <input type="checkbox"/> 10 <input type="checkbox"/> 20 <input type="checkbox"/> 30 <input type="checkbox"/> Unknown	Setting / Rating: A	Manufacturer:
			Model:		

Visual Inspection / Cleaning	Starter Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No	Visual Signs of Overheating: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Cleanliness (As Found): <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Electro/Mechanical Interlock: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Connections <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Contactors Condition: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Ground Connection: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Overload Condition: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Cables Routed Appropriately: <input type="checkbox"/> Yes <input type="checkbox"/> No	Door Mechanical <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Exercise Circuit Breaker/MCP/Disconnect <input type="checkbox"/> Yes	Unit Cleaned: <input type="checkbox"/> Yes
	Comments:	

Final Analysis	Returned to Service: <input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
	Monitoring / Further Inspection Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	
	Repair / Replacement Required: <input type="checkbox"/> Yes <input type="checkbox"/> No	

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				

Note: The person performing the check is responsible for ensuring that the data is transcribed from the handwritten form correctly, and that the analysis results are correct.



INSPECTION FORM AC MOTOR, LOW VOLTAGE

Page: 1 of 2

ID: _____

Project	Facility:	Project Name:
	Area :	Bid Opportunity:

Motor Data	Size: kW / HP	Voltage: V	R.P.M:	
	Manufacturer:	Model:	Serial Number:	
	Frame Type:	FLA: A	Service Factor:	Other:
	Cooling: <input type="checkbox"/> Air <input type="checkbox"/> Fan	# Cooling Fans:	Winding Material:	

Visual Inspection / Cleaning	Motor Identification Tag Installed: <input type="checkbox"/> Yes <input type="checkbox"/> No	Visual Signs of Overheating: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Connections: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Air Baffles: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Paint: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Filter Media: <input type="checkbox"/> N/A <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Cooling Fans: <input type="checkbox"/> N/A <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Fan Controls: <input type="checkbox"/> N/A <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor
	Anchorage/Alignment: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Ground Connection: <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	
	Mechanical/Electrical Noise During Operation: <input type="checkbox"/> Yes <input type="checkbox"/> No	Lubrication Required: <input type="checkbox"/> Yes <input type="checkbox"/> No
	Cleanliness (As Found): <input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	Unit Cleaned: <input type="checkbox"/> Yes Photograph Taken: <input type="checkbox"/> Yes

Winding Insulation Resistance	Stator Winding	Test Voltage (Vdc)	Winding Temperature (°C)	Resistance (MΩ)			Dielectric Absorption Ratio	Polarization Index (a)
				30 Sec	1 min.	10 min. (a)		
		500	40				-	-
		500	40				-	-
		500	40				-	-
Notes:								
(a) Testing to 10 minutes and calculation of Polarization Index is only required for motors > 150 kW (200 HP)								
Test Summary <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive. Further Investigation Required. <input type="checkbox"/> Test Failed								

Winding Resistance	Resistance (μΩ)			Test Summary <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive Further Investigation Required. <input type="checkbox"/> Test Failed
	A - B	B - C	A - C	
Comments:				



INSPECTION FORM AC MOTOR, LOW VOLTAGE

Page: 2 of 2

ID: _____

Bearing Insulation Resistance	<input type="checkbox"/> Not Applicable				
	Bearing	Test Voltage (Vdc)	Bearing Temperature (°C)	Resistance (MΩ)	
				1 min.	Corrected to 40°C
		500			
		500			
Test Summary <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive. Further Investigation Required. <input type="checkbox"/> Test Failed					

RTD Resistance	<input type="checkbox"/> Not Applicable					
	Actual Winding Temperature: _____ °C			Actual Bearing Temperature _____ °C		
	RTD	Resistance (Ω)	Calculated Temperature (°C)	RTD	Resistance (Ω)	Calculated Temperature (°C)
Test Summary <input type="checkbox"/> Test Passed <input type="checkbox"/> Test Inconclusive. Further Investigation Required. <input type="checkbox"/> Test Failed						

Note: Test connection resistance of bolted connections. Report on cable inspection sheet.

Final Analysis	Returned to Service:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Comments:
	Monitoring / Further Inspection Required:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
	Repair / Replacement Required:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	

	Company	Name	Signature	Date (yyyy/mm/dd)
Performed By				
Checked By				

Note: The person(s) performing the check is responsible for ensuring that the data is transcribed from the handwritten form correctly, and that the analysis results are correct.



PLC DISCRETE INPUT CHECKLIST

Project	
Facility:	Project Name:
Area :	Bid Opportunity:

PLC	
PLC ID:	Description:
Rack:	Slot:

Pt	Tag	Description	State	State Desc.	PLC Input	Local HMI	SCADA	Alarm	Pass (P/F)
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	



PLC DISCRETE INPUT CHECKLIST

			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	
			0		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> N/A
			1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> On <input type="checkbox"/> Off	

Comments:

	Company	Name	Signature	Date (yyyy/mm/dd)
Tested By				
Witnessed By				



PLC DISCRETE OUTPUT CHECKLIST

Project

Facility:	Project Name:
Area :	Bid Opportunity:

PLC

PLC ID:	Description:
Rack:	Slot:

Pt	Tag	Description	State	State Desc.	PLC Output	Field Device	Pass (P/F)
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	



PLC DISCRETE OUTPUT CHECKLIST

			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	
			0		<input type="checkbox"/>	<input type="checkbox"/>	
			1		<input type="checkbox"/>	<input type="checkbox"/>	

Comments:

	Company	Name	Signature	Date (yyyy/mm/dd)
Tested By				
Witnessed By				

APPENDIX B.2

CITY OF WINNIPEG MECHANICAL COMMISSIONING CHECKLIST



COMMISSIONING MECHANICAL CHECKLIST

Project

Facility: SEWPCC	Project Name: SEWPCC PRIMARY CLARIFIER TRAVELLING BRIDGES - REFURBISHMENT
Area : Primary Clarifier No.3	City Bid Op. # 682-2018

Equipment List

Tag: N/A	Description: Travelling Bridge Collector
Manufacturer: Dorr-Oliver Canada	Model: N/A Serial Number: 11798-1

Inspection Checklist

No.	Item to be Inspected	Comments	Pass (P/F)
1.	Test run the bridge collector along the full length of the rails without the scraper arm assembly attached and with the clarifier empty. See drawing L-32917 for design speed. See Westinghouse bridge drive motor datasheet for operating current.		
	Company	Name	Signature
Tested By			Date (yyyy/mm/dd)
Witnessed By			

No.	Item to be Inspected	Comments	Pass (P/F)
2.	Test run the bridge collector with the scraper arm assembly attached and with the clarifier empty. Confirm the same minimum performance requirements stated in item 1.		
	Company	Name	Signature
Tested By			Date (yyyy/mm/dd)
Witnessed By			

No.	Item to be Inspected	Comments	Pass (P/F)
3.	Test run the bridge collector with the scraper arm assembly attached and with the clarifier full. Confirm the same minimum performance requirements stated in item 1.		
	Company	Name	Signature
Tested By			Date (yyyy/mm/dd)
Witnessed By			

Comments:

KGS
GROUP
CONSULTING
ENGINEERS

