

APPENDIX D
CONSTRUCTION PLAN

CITY OF WINNIPEG

South End Sewage Treatment Plant
(SEWPCC) Primary Clarifier
Refurbishment Works

Construction Plan

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21-0101-007

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1.0 INTRODUCTION

The South End Sewage Treatment Plant (SEWPCC) is the second largest of the three sewage treatment plants servicing the City of Winnipeg. The SEWPCC is located at 100 Ed Spencer Drive in Winnipeg, Manitoba. The SEWPCC has three 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.

Primary Clarifier Travelling Bridge (PCTB) Nos. 1 and 2, each with a span of approximately 10 meters, were manufactured by Walker Process Equipment and installed in 1971 with some minor rehabilitation work undertaken approximately 15 years ago.

During the winter season of 2018-2019, refurbishment work was completed on PCTB Nos. 1, 2, and 3. The scope of the 2018-2019 refurbishment work included (but was not limited to) the following:

- a) Refurbishment of PCTB No. 3 running rail, cog rail and related drive system components.
- b) Minor structural remediation to the aluminum structure of PCTB No.3.
- c) Replacement of the festoon cable supports for PCTB Nos. 1, 2 and 3.
- d) Replacement of electrical and automation controls for PCTB Nos. 1, 2 and 3.

The electrical work included replacement of the local control panels, new festoon cables, and installation of new remote I/O panels on all three clarifiers.

PCTB No. 3, with a span of approximately 20 meters, was manufactured by Dorr-Oliver Canada Ltd. and installed as part of a plant expansion in 1992. On October 21, 2019, the City engaged KGS Group regarding a crack discovered on the PCTB No. 3 truss. In 2019 an emergency crack repair was completed on the damaged truss.

Reliable operation of the primary clarifier system is critical to the operation the SEWPCC plant. In the past, plant operations staff have expressed concern over the number of travelling bridge components that are failing. This has prompted the refurbishment repair work in 2018, 2019, and 2020. However, additional refurbishment work is required to keep the assets functioning reliably.

This construction plan describes the steps involved in completing the work planned for the 2021 shut-down. It is not intended to describe the work in detail, nor does it address quality control measures any further than is needed to understand the associated scheduled time for a task.

This plan also indicates who the project personnel are and what the communication links between them will be. A proposed construction schedule is presented in Appendix A to indicate the timeframes available to complete the work. This document describes the proposed work sequence for the electrical, structural, and mechanical work planned for PCTBs No. 1 and 2. Each section discusses the steps involved in the work planned.

The construction plan also discusses the methods to be used to minimize the risk to the project schedule posed by unpredictable weather and ongoing work at the plant.

2.0 PROJECT CONTACT PERSONNEL

Communication for the project will be between various City, Contract Administrator, and Contractor personnel. A clear plan for lines of communication is required. Following are the guidelines that should apply.

- The Contractor should request clarifications from the Contract Administrator. If necessary, these will be reviewed with the City, and instruction will be provided to the Contractor as to how to proceed. The Contractor may contact individual Contract Administrator engineers via email, but the Contract Administrator Project Manager must be carbon-copied.
- Contract Administrator may contact various personnel at the City, but the City's Project Manager must be copied on correspondence.
- Should issues arise related to the C4 contract currently underway on-site, the City will advise this project how best to proceed.

A table of contact persons and their information is provided in Appendix B.

3.0 CONSTRUCTION SCHEDULE OVERVIEW

The City intends to award the construction contract in August 2021. The clarifier shutdowns required for contract work to be completed are planned to occur during the winter season when sewage flows are lower. The winter season typically can start as early as November and ends as late as March. However, this cannot be predicted accurately. Therefore, the work must be planned to best exploit the available time. This will allow for the largest possible time contingency to prevent work running into the March/April time frame.

As per the project schedule, clarifier No.2 must be shutdown first as it requires the most refurbishment work and is at a higher risk of breakdown than No.1. Time from contract award to clarifier shutdown will be required for the contractor to prepare, submit shop drawings for review and procure materials. The contractor will also have to inspect and accept mechanical materials purchased by the City. As soon as they are ready to proceed with clarifier shutdown, they shall give 5 days' notice to permit the City to prepare.

The shutdown of clarifier No.2 is planned to start in late November. Once the structural, mechanical, and electrical work is finished, commissioning of the bridge collector will be carried out. Commissioning requirements are presented in the Commissioning Plan in Appendix E of bid opportunity 391-2021. Once clarifier No.2 is back in operation and deemed acceptable to turn over to the City, clarifier no.1 can be shutdown.

A key component of this project schedule will be delivery of mechanical materials required to upgrade clarifiers No.1 and No.2. The contractor will need to have received all the parts for clarifier No.2 before starting the refurbishment works on that clarifier. The package of materials purchased by the Contractor will be shipped to Winnipeg upon approval by the City. The contractor should plan for two shipments. One for the parts for clarifier No.2 to arrive first so that work can start while the other shipment for parts for clarifier No.1 will be on its way.

Creation, issuance, and processing shop drawings may take 4 weeks. With the contract awarded early in August, and work starting in early December, this leaves a limited timeframe for preparation and review of shop drawings.

Note that shop drawings are not required for some materials with long delivery times. Materials requiring shop drawings are identified in the specifications.

The mobilization and demobilization of the Contractor's team will not require the clarifier to be shut down. This includes unloading the City supplied parts, setting up a storage area outside the building, carrying out inspections on those parts, unloading and setting up equipment, and completing safety orientations. All of the related demobilization activities can be done after the clarifiers are turned over to the City.

The mechanical specification requires the Contractor to provide Safety and Quality Control (QC) methodology documents to the Contract Administrator for the rails and bridge drive system work. In addition to this, there are two Inspection and Test Plans (ITP) to be completed, one for the rails and anchor bolts, and the other is for the bridge drive system. Additionally, there are two QC checklists provided to the Contractor in the specification that are required to be completed as part of the ITPs. Each stage of the ITP document requires signoff by the Contractor, the OEM representative, and the Contract Administrator in order to continue with the next step. As such the Contractor must coordinate the ITP signoff with the Contract Administrator.

4.0 CLARIFIER SHUT DOWN AND TURNOVER

To shut down and cut off flow to and from one of the clarifiers, City operations personnel will divert flow from the clarifier, drain its contents, and prepare the clarifier for turnover to the Contractor.

The bridge will then be placed in the service area at the west end. The City will disconnect and lockout power and controls for the bridge. The Contractor will also lock-out and tag the same electrical breaker switches. The clarifier will then be turned over to the Contractor.

After the clarifier is shut down, the Contractor will lift the PCTB and rest the end-trucks on wood blocks or dunnage, supporting the bridge at midspan if necessary. The scraper arm can then be disconnected and rested on the concrete under the PCTB.

5.0 MECHANICAL

This section lists the steps involved for the mechanical refurbishment work on a given clarifier. While the mechanical works are underway, the minor structural and electrical work can proceed in parallel on the same unit. The electrical and structural scope can be completed within the time required to complete the mechanical works as they are significantly less in scope. The structural and electrical should be completed early in the clarifier shutdown period during demolition and disassembly. This is to ensure that the ancillary work is complete when the new rails and drive shafts are installed to avoid disrupting mechanical alignment. A detailed list of mechanical work is included in Appendix C to assist the contractor in defining the steps/tasks required. A different work sequence may be acceptable if reviewed and approved by the Contract Administrator.

5.1 Disassembly and Demolition

The Contractor must have their equipment set-up and ready, prior to shutdown and turnover. The following is a listing of tasks involved in the disassembly and demolition of one PCTB separated into rail and drive related work and shown in sequential order. The rails and the drive shaft system are shown separately because the tasks are mostly independent and can therefore be completed concurrently.

5.1.1 RAIL AND RACK

1. Unbolt, cut, and dispose of the sections of used rail and rack. No portion of the existing rack or rail is to be re-used.
2. Remove the sole plates, chip the grout pads away, cut the anchor bolts. Prepare the area for new bolts and rails.
3. Patch the sections of grout that were chipped for the removal of the existing anchor bolts using approved mortar cement repair mix.
4. Coordinate signoff of the ITP with the Contract Administrator to proceed with installation of the City supplied parts.

5.1.2 DRIVE SYSTEM

1. Once the clarifier is shut down, lift the PCTB and rest the end-trucks and structure on wood blocks or dunnage, supporting the bridge at midspan.
2. Unbolt and disconnect the scraper arm and rest it on the concrete under the PCTB.
3. Remove all chain guards, loosen and remove main drive and pinion roller chains.
4. Take detailed measurements of bearing and sprocket positions throughout the drive system. These will be required for re-assembly.
5. Loosen and remove the driven sprockets from each pinion axle. Unbolt and remove flange bearings on the running wheel and pinion axles.
6. Once disconnected, the running wheel and the pinion axles can be removed, carefully lowering the wheels and pinions onto a dolly while retaining all clips, rings, pins, and set screws.
7. Unbolt and remove the pillow blocks, coupling, drive, and driven sprockets on the main drive shaft sections.
8. Lift the two sections of the main drive axle onto a dolly and ship to the Contractor's shop for cleaning/measurement. Retain all clips, rings, pins, and set screws.
9. Remove the drive sprocket from the gearbox output shaft.
10. Remove the remaining pillow block bases, tops, and any other miscellaneous items.
11. Upon removal, the above items are to be labelled, inspected, photographed, packaged, and stored in the event they are required for re-use. This includes all fasteners, seals, and other small miscellaneous parts. Coordinate signoff of the ITP with the Contract Administrator.

5.2 Installation

As noted previously, some activities can occur concurrently. However, care should be taken during alignment of the bridge shafts and axles that there is no vibration caused by other construction activities that may result in poor alignment.

5.2.1 RAIL AND RACK

- Prior to shut down of the clarifier, submit the new anchor bolt layout for review by the Contract Administrator. This layout is to be designed by the Contractor and submitted as a shop drawing.
- Survey and mark new anchor bolt locations using the fixed starting point (or datum) shown on the marked up copy of drawing 4S33416-1 (see Appendix K of bid opportunity 391-2021) and the center of the span between the north and south rails. The center of the clarifier is to be used as the starting point for the installation to ensure that the buildup of misalignment is minimized. Coordinate signoff of the ITP with the Contract Administrator. Drill and install anchor bolts.
- Survey and mark the locations of the new grout pads on the concrete floor along the new rail alignment. Chip away existing concrete to specified depth and clean away debris. Build grout forms around installed

anchors, and roughly level and align the sole plates using leveling bolts. Coordinate signoff of the ITP with the Contract Administrator. Apply grout and provide minimum cure time as required by manufacturers recommendations.

- Re-survey the sole plates and record new shim pack heights on a marked up copy of the anchor bolts shop drawing. The neoprene pads can then be applied to the grout pads along with the shim packs. The sole plates will then be placed on top and then re-aligned.
- Align and install the ASCE 40AS running rail and $\frac{3}{4}$ inch thick mild steel cog track pieces using the same datum and centerline as the anchor bolts. Each piece of rail or cog track shall be placed, aligned, measured, and cut/drilled to fit. The cog rail tooth profile must be installed such that it is as precisely in phase with the opposite side as possible. This will progress along each side until the rail has reached the service area, where the installation of these pieces will be coordinated with the work on the bridge.

It is possible that during drilling, some issues such as rebar may cause the hole position to be out of tolerance. If this does occur it is important that the resulting misalignment is reported. Once the holes have been drilled, the contractor will provide a marked up copy of the original shop drawing showing actual locations of the bolts. The resulting rail misalignment can be accommodated with shims, slotting of bolt holes or other techniques.

5.2.2 DRIVE SYSTEM

- Upon delivery of the shaft assemblies to the Contractor's shop clean, inspect, and photograph each of the assemblies to record and report damage or defects. Measure the shafts for concentricity, runout, and other defects. Provide a shop drawing showing the measurements taken. Coordinate signoff of the ITP with the Contract Administrator.
- Check the pillow block and flange bearing bolting surfaces on the bridge structure for elevation, translation, and levelness. Using these measurements, build shim packs to keep the main drive shafts within parallel and angular alignment requirements, and mark-up the existing drawings as required in ITP. Install the new pillow block bases and check the alignment.
- Install the two main drive shaft sections on the pre-aligned pillow block bases starting with the section that has the 45-tooth driven sprocket. Align the remaining section using the sprocket shaft as the driving component. Report angularity, offset, and gap on a mark-up drawing. Coordinate signoff of the ITP with the Contract Administrator.
- Align the pinion axles (driven) to the main drive shaft rigid coupling hubs (driving). This alignment must also account for the requirements of the rack, such as inclination, and camber. The elevation of the contact point of the pinion is determined once the bridge is lowered back on the rails. However, this can be corrected later by adjusting the running wheel axle flanged bearings vertically (if possible). Align both pinions so that they are in full contact with the rack teeth at the same time. Coordinate signoff of the ITP with the Contract Administrator.
- Install and align the running wheels after the cogwheels, as the running wheels may need to be adjusted to achieve the correct final elevation of the contact point between the pinion and the rack teeth at the tooth profile pitch line. Because the running wheels are flanged on one side and flat on the other, they are intended to allow some amount of sideways variation relative to the top of the rail head.

- Lower the bridge to the desired pinion contact elevation with the rack. Lift the bridge collector again and adjust the running wheels to reach the required alignment. Coordinate signoff of the ITP with the Contract Administrator.

Because friction and wear at the running wheels has been a cause of excessive torque and bridge malfunction in the past, the alignment of the bridge is critical to the proper functioning of the machine as a whole. As such the contractor's focus should be on this portion of the work.

Position and secure the main drive shafts, axles, and connecting components using measurements taken from the dis-assembly stage. Verify dimensions and fitting tolerances with the OEM. All components should have a locational clearance fit with a set screw. If a hydraulic press fit or shrink fit is required, confirm with the Contract Administrator prior to work.

6.0 ELECTRICAL WORKS

As noted earlier, electrical works would be completed during the initial mechanical works on this clarifier. The electrical scope of work shall proceed concurrently with Mechanical and Structural on the same clarifier. The electrical scope of work on Primary Clarifier Traveling Bridges 1, 2 and 3 are similar, which include:

1. Disconnection and removal of the two (2) existing motor's power wiring and associated conduits on Primary Clarifier Traveling Bridges 1, 2 and 3.
2. Installation of new power wiring, disconnect switches and associated conduits for the two existing motors on Primary Clarifier Traveling Bridges 1, 2 and 3.

7.0 STRUCTURAL WORKS

Minor structural repairs to the Primary Clarifier Traveling Bridges shall be completed during the initial clarifier shutdown period. The mechanical works will establish the overall time required to complete the refurbishment work for each clarifier. While the mechanical refurbishment works are underway, the structural scope of work shall proceed in parallel on the same clarifier. In addition to the rail and rack refurbishment work specified in Section 5, the following items are included in the structural scope of work:

1. Certified structural inspection of Primary Clarifiers No. 1 & 2 bridge structures shall be conducted as per the Structural Steel Specification.
2. Primary Clarifiers Travelling Bridges No.1 and 2 guard rail post repairs, platform checkered plate existing stitch weld repairs and bridge guardrail repainting shall be performed as per the design drawings and specifications.
3. Primary Clarifiers Travelling Bridge No.1 and 2 structural steel weld repairs, if required based on certified structural inspection recommendations, and paint-touch ups shall be performed as per specifications.

4. Primary Clarifier Travelling Bridge No. 3 bridge truss repairs shall be performed as per the design drawings and Primary Clarifier No. 3 Aluminum Bridge Repairs Specification.

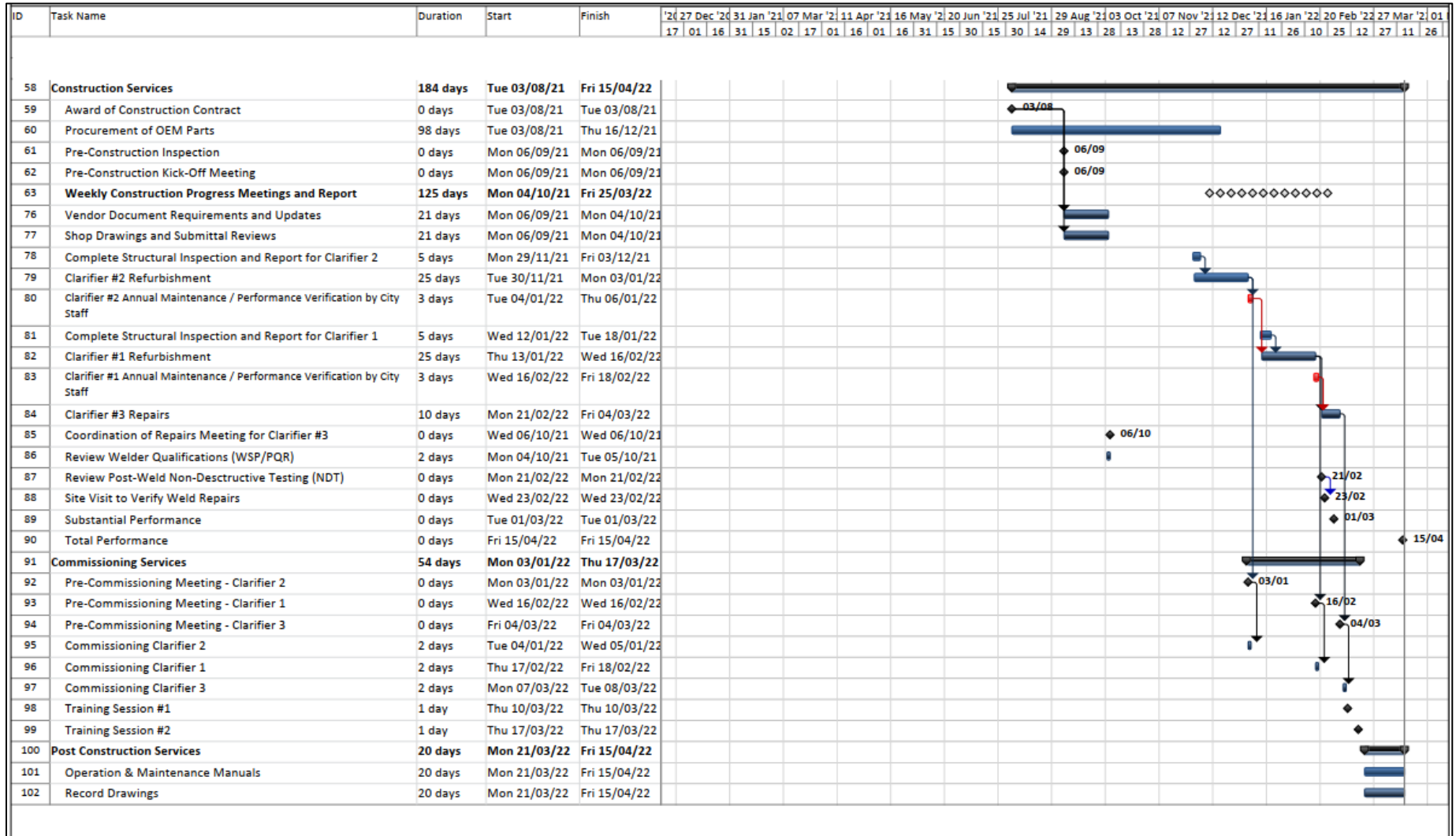
8.0 COMMISSIONING AND HANDOVER TO CITY

At the end of the construction phase, the contractor will undertake the commissioning of each of the clarifier travelling bridge collectors. The Commissioning Plan document details the steps involved and the time required to complete the commissioning of each bridge collector. Following the commissioning of the equipment the contractor will hand-over each of the primary clarifiers to the City for process start-up.

APPENDIX A

Proposed Construction Schedule

Proposed Construction Plan Schedule



APPENDIX B

Contact Information Table

Tender 391-2021: CONSTRUCTION PLAN - APPENDIX B
TABLE OF CONTACT INFORMATION

First	Last	Organization	Role	Phone	Email
name	name	CONTRACTOR1	Project Manager		
name	name	CONTRACTOR1	Job Superintendent		
name	name	CONTRACTOR1	Field Supervisor (Foreman)		
name	name	CONTRACTOR2	Project Manager		
name	name	CONTRACTOR2	Job Superintendent		
name	name	CONTRACTOR2	Field Supervisor (Foreman)		
Colin	Siepmann	KGS Group	Project Manager	204-896-1209 ext. 283	csiepmann@ksgroup.com
Lunide	Milius-Alphonse	KGS Group	Contract Administrator	204-896-1209 ext. 354	lmilius-alphonse@ksgroup.com
Ravi	Chitikireddy	KGS Group	Structural Engineer	204-896-1209 ext. 289	rchitikireddy@ksgroup.com
Dennis	Guevarra	KGS Group	Electrical Technologist	204-896-1209 ext. 491	dguevarra@ksgroup.com
Dustin	Wilson	KGS Group	Electrical Engineer	204-896-1209 ext. 297	dwilson@ksgroup.com
Colburn	Holbrook	KGS Group	Mechanical Engineer	204-896-1209 ext. 352	cholbrook@ksgroup.com
Tim	Turzak	City of Winnipeg WWSD	Project Manager	204-986-3760	tturzak@winnipeg.ca
Shane	Westover	City of Winnipeg WWSD	SEWPCC Supervisor	204-619-1265	swestover@winnipeg.ca
Dean	Kosowan	City of Winnipeg WWSD	Supervisor Mech. Maintenance	204-986-4120	dkosowan@winnipeg.ca
Brent	Soloway	City of Winnipeg WWSD	Supervisor Elec. & Instr. Maintenance	204-451-4521	bsoloway@winnipeg.ca

APPENDIX C

Suggested Sequence of Work

BID OP . 391-2021: CONSTRUCTION PLAN - APPENDIX C
TRAVELLING BRIDGE COLLECTOR DRIVE SYSTEM SEQUENCE OF WORK

#	Task	Action	Object
1	Accept delivery of City Supplied Materials	SET-UP	
2	Set up equipment and materials storage at designated laydown area	SET-UP	
3	Shut down primary clarifier (CITY)	SHUT-DOWN	
4	Prepare bridge collector for maintenance and roll it to service area (CITY)	SHUT-DOWN	
5	Handover of clarifier from City to Contractor	SHUT-DOWN	
6	Lift Bridge collector off rails / tracks	DISASSEMBLY	END TRUCKS
7	Disconnect the scraper arm	DISASSEMBLY	SCRAPER ARM
8	Remove all chain guards, roller chains	DISASSEMBLY	CHAIN
9	Measure bearing and sprocket locations	ALIGN	MAIN DRIVE SHAFT
10	Remove existing 19T sprocket from gearbox output shaft	DISASSEMBLY	DRIVE SPROCKET
11	Disassemble main drive shaft coupling	DISASSEMBLY	MAIN DRIVE SHAFT
12	Disassemble main drive shaft pillow blocks	DISASSEMBLY	MAIN DRIVE SHAFT
13	Remove main drive shaft sections prep for shipment	DISASSEMBLY	MAIN DRIVE SHAFT
14	Remove, tag, and store any remaining loose parts	DISASSEMBLY	MAIN DRIVE SHAFT
15	Ship equipment to shop	DISASSEMBLY	ALL
16	Inspect and photograph shafts upon delivery to shop	INSPECT	ALL
17	Remove coupling hubs from drive shaft sections	DISASSEMBLY	MAIN DRIVE SHAFT
18	Remove bearings, sleeves from drive shaft sections	DISASSEMBLY	MAIN DRIVE SHAFT
19	Unbolt/remove running wheel axle flange bearings	DISASSEMBLY	RUNNING WHEELS
20	Remove running wheel assembly	DISASSEMBLY	RUNNING WHEELS
21	Remove driven sprocket from pinion axles	DISASSEMBLY	PINIONS
22	Unbolt/remove pinion axle flange bearings	DISASSEMBLY	PINIONS
23	Remove pinion assembly and store	DISASSEMBLY	PINIONS
24	Check alignment of bearing mount surfaces	ALIGN	MAIN DRIVE SHAFT
25	Install new 19T sprocket on gearbox output shaft	ASSEMBLY	MAIN DRIVE SHAFT
26	Rough align main drive shaft pillow blocks (without shaft/bearings)	ALIGN	MAIN DRIVE SHAFT
27	Rough align running wheel axle flange bearing housing (without shaft/bearings)	ALIGN	RUNNING WHEELS
28	Rough align pinion axle flange bearing housing (without shaft/bearings)	ALIGN	PINIONS
29	Install new coupling hubs and new bearings/sleeves on new main drive sections	ASSEMBLY	MAIN DRIVE SHAFT
30	Install main drive shaft sections	ASSEMBLY	MAIN DRIVE SHAFT
31	Check alignment of main drive shaft sections	ALIGN	MAIN DRIVE SHAFT
32	Assemble drive shaft coupling	ASSEMBLY	MAIN DRIVE SHAFT
33	Install pinion axles	ASSEMBLY	PINIONS
34	Install and position new bearings/sleeves and sprockets on pinion axles	ASSEMBLY	PINIONS
35	Check alignment of pinion axles to main drive shaft	ALIGN	PINIONS
36	Install and position new bearings/sleeves on running wheel axles	ASSEMBLY	RUNNING WHEELS
37	Install running wheel axles	ASSEMBLY	RUNNING WHEELS
38	Check alignment running wheel axles	ALIGN	RUNNING WHEELS
39	Lower Bridge collector	ASSEMBLY	END TRUCKS
40	Check alignment of pinion to rack	ALIGN	PINIONS
41	Check alignment running wheels to running rail	ALIGN	RUNNING WHEELS
42	Lift bridge collector	ASSEMBLY	END TRUCKS
43	Shim running wheels	ASSEMBLY	RUNNING WHEELS
44	Lower Bridge collector	ASSEMBLY	END TRUCKS
45	Install drive chains	ASSEMBLY	CHAIN
46	Re-assemble chainguards	ASSEMBLY	CHAIN
47	Lubricate chain guards, bearings, gearbox, etc.	LUBRICATE	ALL
48	Bridge collector commissioning	COMMISSION	
49	Clean-up clarifier service area	CLEAN	
50	Handover of clarifier from Contractor to City	START-UP	
51	Teardown equipment in laydown area	TEAR-DOWN	
52	Discard waste materials	TEAR-DOWN	

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Experience in Action