

Submittal No. 951Revision No. 1

Kiewit Infrastructure West
10220 SW Greenburg Rd., Portland, OR 97223

To: ATTN. STANTEC CM'S	From KIEWIT INFRASTRUCTURE WEST CO.
Stantec Consulting Services, Inc.	Date: 07/14/2023
5001 N. Columbia Blvd.	Project: CBWTP Secondary Treatment Expansion Program
Portland, OR 97203	Project No.: E07947

Submitted By: Michael Hassard	
Title: Master Startup and Commissioning Plan Rev B	Type: Commissioning Start-up Plan
Phase: GMP 2	Location: General

Specification	Descriptions
01 75 16	Facility Start-up
01 78 23	Operation and Maintenance Data
01 43 33	Manufacturer's Field Services (Training)
40 90 00	Instrumentation and Controls
23 05 93	Testing Adjusting and Balancing for HVAC
23 52 90	Remote Boiler Plant
NA	CM/CG Site Specific Health and Safety Plan
01 75 16	Facility Start-up
<input type="checkbox"/> Expedite	Reason for Expediting
Respond by: 08/07/2023	

Final Disposition:	Project	CBWTP STEP GMP#2
No Exceptions Taken	Project No.	709068CH
X Make Corrections Noted	Submittal Title	01 75 16 - CBWTP-CSU-0001.0 REV A - Master Startup and Commissioning Plan
Submit Specified Items	Submittal No.	951.01
Revise and Resubmit	Primary Reviewer.	Green (Dooley, Jackson, Mueller, Walter, Harbert, Watson)

NO.	SUBMITTAL COMMENT	RELATED SPEC PARA.	REVIEWER	KIEWIT'S RESPONSE
1	See embedded comments in attached submittal document	Misc.	Green, Brunkow, Walter	Please note: Comments embedded in submittal document do not include Spec references. Document section is listed here to aid in cross referencing.
1a	Describe how project stakeholders will participate. Ie. O&M staff, BES engineering, designers. O&M activities are continuous and impact resource availability.	Misc. (Section: 1.0)	Green, Brunkow, Walter	1.0 Verbiage updated per comment.
1b	Suggest including as much detail as can be developed in a preliminary session for one CSU to convey tools for information management, intended level of detail, specific activities, interface and responsibilities for each party, schedule snapshot for this CSU, training activities, anticipated meetings. This sequence should also cover, electrical commissioning, HVAC, lighting, fire alarms, coms, required inspections and interface with other unit processes such as clarifiers and tunnels, yard piping. Present in general sequence required with placeholders for information generated by others e.g. Jacobs, mfr, owner. Include all applicable forms and spreadsheets to represent the management of this information.	Misc. (Section: 2.1.1 CSU-0008)	Green, Brunkow, Walter	As put forth in comment #2, this Commissioning and Start-up [overall] Master procedure is somewhat of "an introductory chapter." The required level of detail described in this comment and others below is only possible in the forthcoming System Commissioning and Start-up procedures. This seems to be understood by the reviewer as the comment is directed at a specific individual system on the overall system list. CM/GC agrees with this and all other similar comments below. This level of detail will be provided in the individual system 'master' procedures.
1c	The start up and commissioning plans should identify the work groups participating. For instance operations, instrumentation, electrical, HVAC, SCADA are all different work groups that will need to schedule resources.	Misc. (Section: 2.1.2)	Green, Brunkow, Walter	Added Section 2.3.1 Stakeholders to identify the work groups participating.
1d	This plan and associated schedule must be shared with stakeholders as soon as possible and then regularly as any changes occur. This plan should allow stakeholders to see how the component startups within a system impact other systems.	Misc. (Section: 2.2)	Green, Brunkow, Walter	Changed "plan" to "schedule" Master start-up and testing schedule is integrated in P6 and will not be included in this doc as changes to P6 would require updates here. Individual system procedures will contain applicable data from P6 at time of issue. "Cutover Strategy" Procedure (estimated issue Aug 4, 23) reflects simultaneous system start-ups. (see also 1h)
1e	needs to be submitted and approved prior to product shipment (MCOC, MCOFT)	Misc. (Section: 5.1, 5.2)	Green, Brunkow, Walter	5.1, 5.2 - Updated verbiage per comment
1f	Recommend communicating the schedule to O&M staff as soon as possible. The scope of all training and any retraining for people who did not obtain proficiency the first time or who missed the training. There is a nuance to timing the training to the startup and commissioning. This will pose a challenge to scheduling resources.	Misc. (Section: 6.2.1)	Green, Brunkow, Walter	Acknowledged. Kiewit will provide Owner operator training as per spec. As per spec, audio/video of training sessions, as well as handouts will be submitted to Owner to ensure future operators receive adequate training. PICs/P6 contain training schedules. Updated verbiage in 6.2.1 & 6.2.2 to address these comments.
1g	(ORT-2) IS: These works will be performed by Engineer and Engineer's Contractor. SB: These works will be [GENERALLY BE LED BY] performed by Engineer and Engineer's Contractor [AND SUPPORTED BY KIWC EQUIPMENT VENDORS AND IN SOME CASES BES].	Misc. (Section: 7.2)	Green, Brunkow, Walter	7.2 verbiage updated as per comments
1h	Process control cut over strategies will need to address the process constraints identified in the construction constraints register. (Yellow) this will be a very time consuming joint effort of the start-up team to develop these strategies - that will likely continue to evolve and impact schedule throughout (Pink)	Misc. (Section: 8.1)	Green, Brunkow, Walter	Separate Cutover Strategy doc is in works. ETA early Aug 2023 Process constraints included in consideration and cutover is being vetted against master schedule to ensure no conflicts. Master Sched was developed with these system start-up combinations at forefront of consideration. 8.1 verbiage has been added to address these comments and reference the cutover strategy document.



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1i	Recommend developing an approved plan for when performance testing does not show compliance with the specification. This will include the manufacturer's commitment.	Misc. (Section: 8.4)	Green, Brunkow, Walter	Acknowledged. Updated 8.4 to address non-compliance events and remedial process.
1j	This is not really Jacobs' commissioning. Many of these activities are Contractor activities. As a starting point, see the previous responsibility matrix developed by the Jacobs team.	Misc. (Section: Appx ORT-2)	Green, Brunkow, Walter	Appendix A, ORT-2 verbiage updated as per comments
2	This Master Startup and Commissioning Plan (Submittal 951) is more of an introductory chapter but a "System Master Test plan" shall be submitted for each unit process and system noted in Section 1.06.A.1.b (at a minimum).	1.06.A.1.b	Green	Acknowledged. Please see 1b.
3	"Systems" are further defined under Definitions, in Section 1.03.O: 1. Systems include the main process equipment elements and the associated components that are associated with a specific unit process or facility. Systems are made up of, but are not limited to the following: a. Equipment. b. Control valves. c. Operators. d. Actuators. e. Monitoring equipment. f. Protective switches. g. Instrumentation. h. Variable frequency drives (VFDs). i. Motor control centers (MCCs). j. Package system PLC/IO and Logic. k. Local control panels. l. Human Machine Interfaces (HMI). m. Alarms. n. Networks.	1.03.O	Green	Acknowledged: Spec paragraph 1 has been quoted in procedure. 'Including but not limited to' list was left out as system specific procedures will include a complete list of components and devices by tag # along with specific checksheets for each.
4	Submit Master Startup and Testing Plan as defined. Section 1.03.A.3 defines the Master Startup and Testing Plan as follows: a. The narrative descriptions of testing approach for all STEP facilities, including descriptions of impacts to Owner's operations and maintenance resources (labor, utilities, etc.), testing medium and sources, and conditions of testing. b. The plan shall be developed for each system as described in Article Submittals. c. The plan shall include a detailed comprehensive schedule for all field testing and startup activities for all equipment. Including training, types of tests, plans, procedures, dates, etc. with associated activities durations and sequencing. d. Format requirement shall be the same as for the Operations and Maintenance (O&M) manuals specified in Section 01 78 23, Operation and Maintenance Data. The Master Startup and Testing Plan is further defined in Section 1.06 Submittals.	1.03.A.3	Green	Acknowledged. Please see 1b. Note "Master" in spec references individual System Procedures where "Master" in this document is referring to this "introductory" or "overarching umbrella" document.

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5	<p>Submit detailed comprehensive schedule for all field testing and startup activities as defined by Section 1.03.A.4:Comprehensive Testing Schedule:</p> <p>a. List all equipment testing by specification section number and name. Include the following for each equipment/system:</p> <ol style="list-style-type: none"> 1) Specification section, paragraph number, and applicable equipment tags. 2) Forecasted installation completion dates. 3) Manufacturer representative visit dates. 4) Datalogging List submittal, review, and approval dates. 5) Preliminary Training Schedule. 6) Test type (pressure, leak, watertightness testing, functional, performance, startup). 7) Test Plan and procedure submittal dates. 8) Testing and startup dates. 9) Equipment rotation schedule. 10) Test Report submittal dates. <p>b. As part of the Comprehensive Testing Schedule, a checklist of the status for all predecessor items must be maintained by the Startup and Commissioning Manager. This includes from beginning the startup process (e.g., the construction/ Submittals Test Phase and pre-commissioning activities), and all the way up through the Demonstration Testing.</p>	1.03.A.4	Green	Acknowledged. Please see 1h - Cutover Doc
6	<p>As noted in Kiewit's Process and Utility Sub-System Turnover graphic, all components need to be included as part of the Master Startup and Testing Plan.</p> <p>Component:</p> <ol style="list-style-type: none"> 1. Components comprise every equipment item associated with the project. <p>Example types of equipment, but are not limited to, include:</p> <ol style="list-style-type: none"> a. Equipment, including pumps, tanks, process treatment equipment, and all other mechanical equipment. b. Valves; manual and automated. c. Piping and piping appurtenances. d. Electrical system component examples include wiring, panels, MCCs, VFDs and other electrical appurtenances. e. HVAC equipment (fans, air handling units (AHUs), etc.). f. Control system component examples include instruments, instrument networks, process control networks, network communication racks, switches, and panels. 	1.03.B	Green	Acknowledged. Please see 1b.
7	Some testing requirements are specified in separate sections (e.g., Section 26 08 00, Commissioning of Electrical Systems and Section 23 05 93, Testing, Adjusting, and Balancing for HVAC) specifying testing which generally need to be completed prior to facility startup.		Green	Acknowledged. The sequence of system start-up is addressed in Cutover Doc. Please see 1h Level of detail described will be incorporated in system specific pro's. Please see 1b
8	Incorporate constraints into the Master Testing and Startup Plan, as defined in Section 01 75 16 and Section 01 14 00, Work Restrictions, which provides constraints associated with the construction work sequencing and startup testing periods.		Green	Constraints register included in PICs planning and confirmed in Cutover Doc. Please see 1h
9	Jacobs would suggest that Kiewit select one significant unit process as a sample system, develop a detailed Master Startup and Testing Plan for that sample system, along with a detailed comprehensive schedule, and submit that for review (prior to submitting all the other unit processes and systems).		Green	Mixed Liquor Pumps CSU-0003 identified as best pathfinder. This was the intent with Boiler and although base structure will be repeated, the Boiler PRO may be too different, too 'basic' to be used as example. Regarding "Master" please see #4
10	Jacobs would also suggest a small group meeting with Kiewit's startup and commissioning team to discuss the approach to the Master Startup and Testing Plan, the comprehensive schedule, grouping of unit processes and systems, presentation of materials, general timelines for startup (as developed in prior monthly startup meetings), etc. prior to resubmitting this submittal.		Green	Acknowledged. 1st meeting scheduled 07/13/23 Semi-weekly meeting to be scheduled in future to progress this agenda.



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11	Paragraph 7.2 ORT 2. Change text to read "These works will be performed by Engineer and Engineer's Contractor with assistance from Kiewit's PIC System Integrator. Modify your flow chart to indicate Jacobs/Kiewit under ORT-2	40 90 00 1.01.B.9 - 13 40 90 00 1.04.B.I.3	dwatson	7.2 verbiage updated as per comments (see also 1g) Appx A; ORT-2 verbiage updated as per comments (see also 1g, 1j)
12	CSU table, add WAS flow control under CSU-0014		dwatson	Completed. Added as CSU-0014g
13	Submitted 2.1.2 includes control networks, which only covers for individual processes or facilities. 40 95 80 requires that the network be tested as a complete functional system. Recommend adding a CSU for networks, with subsystems of control networks, security network, and city network.	40 95 80 3.05.J	dwatson	Added CSU-0025 - Networks
14	It is assumed that the commissioning and start of the LEED Gold certified Slough building will be a separate and distinct process that is lead and coordinated by Kiewit/PMC in close coordination with the design team/sustainability consultant.		B. Jackson	Added section 2.1.3 to address Slough & STO-6
15	Under Systems List, SECL9/10 dewatering pumps - remove "s", there is only one dewatering pump. There are two Water Quality Monitoring Stations, only one is listed. WWEFC and SI Flodar flowmeters are not listed. Secondary Effluent Flow Meter is not listed. Org chart is not too useful at such a small scale.		Jeff Maag	Completed. 2.1.1 Systems list updated as per comment. 2.3 Org Chart updated



Master Commissioning & Start-up Plan

Columbia Blvd WWTP STEP (GMP-2)

Kiewit Infrastructure West Co.

CBWTP-CSU-0001.0

REV: B ISSUED: JULY 14, 2023

Commissioning & Start-up Procedure



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Revision Control Sheet

Rev	Section	Change Noted
B	1.0	Updated verbiage to describe how project stakeholders will participate as O&M activities are continuous and impact resource availability.
B	2.2	Changed “plan” to “Schedule”
B	2.1.1	Systems List: Updated CSU-0008b Dewatering “Pump” Updated CSU-0011 Water Quality Monitoring “Stations” Added CSU-0014g WAS Flow Control Added CSU-0024 WWEFC & SI Flow Measurement Added CSU-0025 Networks
B	2.1.3	Added Section 2.1.3 to address Slough & STO-6 buildings.
B	2.3	Updated Org Chart for legibility.
B	2.3.1	Added Section 2.3.1 Stakeholders to identify the work groups participating.
B	5.1, 5.2	Verbiage updated as per comments (MCOC, MCOFT).
B	6.2.1	Added verbiage to address scheduling comments.
B	6.2.2	Added verbiage to address comments regarding future training.
B	7.2, App A	Verbiage updated as per ORT-2 comments.
B	8.1	Verbiage added to address cutover strategy and system start-up sequencing (including simultaneous requirements) comments and reference the cutover strategy document.
B	8.4	Verbiage added to address performance testing compliance comments.

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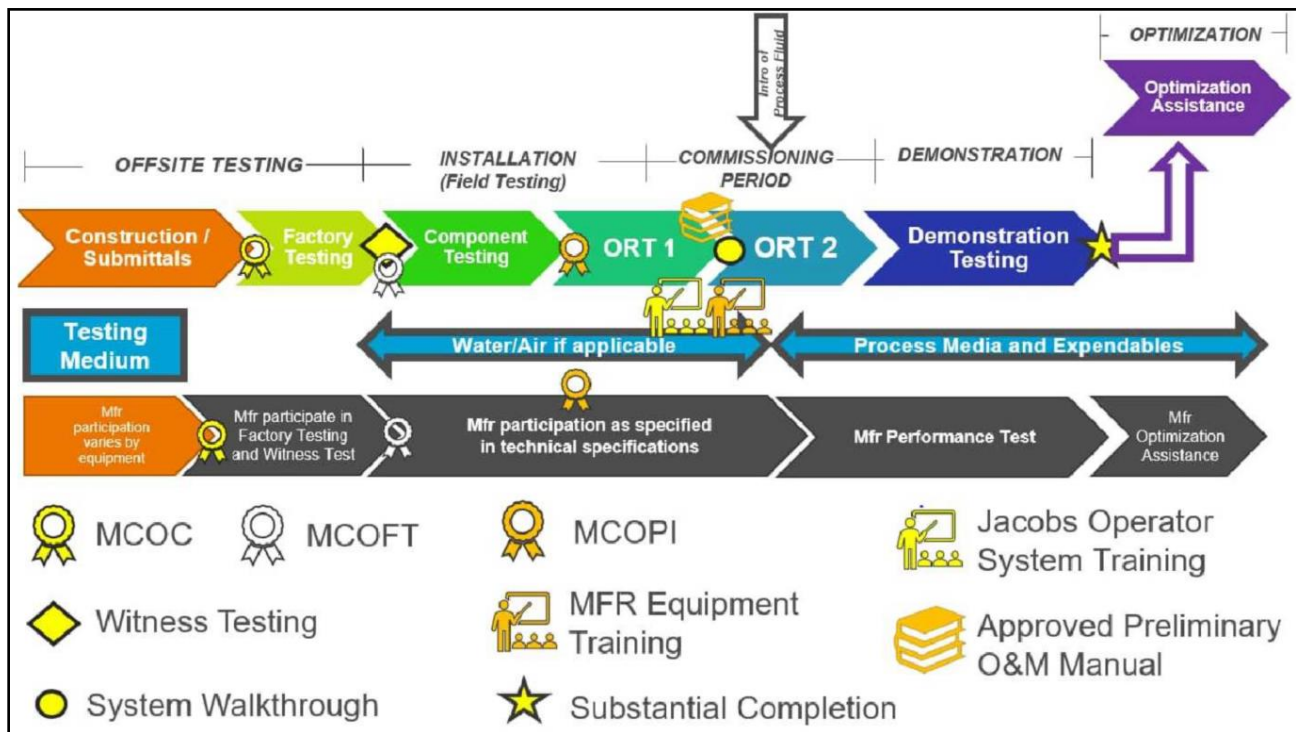
1. Purpose

The purpose of this document is to outline how the Kiewit Commissioning Team will coordinate all completion activities during the execution of the Columbia Boulevard Wastewater Treatment Plant (CBWTP) Secondary Treatment Expansion Program (STEP) GMP-2 commissioning and start-up (CSU) phase (the period of time following the Installation Period whereby the Construction Manager/General Contractor (CM/GC) and the Owner demonstrate the proper installation, functional integrity and operability of the work). Ongoing monthly coordination meetings with all stakeholders and future PICS meetings with relevant stakeholders will identify systems that need further discussion, vetting, coordination with O&M staff, CM/GC, and Owner.

This document will detail the plans and procedures needed to develop and achieve a safe and successful commissioning and start-up.

The CSU activities will be divided into 3 Phases:

- Phase 1: Verification of Construction Completion: MCOC, MCOFT, MCOPI)
- Phase 2: Pre-Commissioning - Operational Readiness Testing 1 (ORT-1)
Commissioning - Operational Readiness Testing 2 (ORT-2)
O&M Training (as required)
- Phase 3: Start-up including Demonstration & Performance Testing, and Optimization assistance (as required)



MCOC - Manufacturer's Certificate of Compliance
MCOFT - Manufacturer's Certificate of Factory Testing
MCOPI - Manufacturer's Certificate of Proper Installation
ORT-1/2 – Operational Readiness Testing

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2. Scope

The Scope of this document is to produce an overall completions and hand over strategy covering all major aspects of commissioning and start-up activities required to complete the CBWTP Project. It will describe development and execution requirements of the individual systems' procedures (which will be submitted separately) covering the complete testing and start-up program including offsite, field installation, component testing/certification, ORT1, ORT2, demonstration and performance tests and process optimization.

This document describes the CM/GC's commissioning infrastructure. This document will also indicate how the owner, owner's representatives, sub-contractors, and vendors will participate in the Commissioning and Start-up of this facility.

Identification and planning of each activity will be incorporated in the overall commissioning and project schedule.

2.1 Systems / Sub-systems

Systems include the main process equipment elements and the associated components that are associated with a specific unit process or facility. In addition, several systems listed below have been divided (where appropriate) into Sub-Systems in order to facilitate early MC, functional testing, and cleaning of a sub system.

Each system's commissioning activity will be analyzed in detail (in conjunction with vendor's scope/ requirements) to enable logical, sequential, and timely completion of the work and to produce specific procedures covering commissioning Phases 1, 2, & 3. The owner's representatives will review and comment on each procedure before implementation at the site.

The individual system procedures will include a detailed, comprehensive schedule showing commissioning activities durations and sequencing for all equipment.

Where possible, system boundaries will be made where there is an isolation valve or a means of physical separation such as flanges to enable safe commissioning of one system in isolation of another.

2.1.1. Systems List

Commissioning and start-up works will be performed and documented separately for each of the following systems & sub-systems in a separate procedure/submittal:

CSU Doc#		Title
CSU-0001	G	Master Commissioning & Start-up Procedure
CSU-0002	M	Remote Boiler Package
CSU-0003	L	Mixed liquor (ML) pumping systems.
CSU-0004	L	Modifications to RAS pumping systems at the Silver Tunnel (TUSI).
CSU-0005	L	Modifications to sump system at Blue Tunnel and SLPR.
CSU-0006	L	Secondary Clarifiers (SECL) 9 and 10.
a)	L	SECL Mechanisms.
b)	L	WWPW Cannons on SECL 9 and 10.
CSU-0007	L	Secondary Scum Pumps
CSU-0008	L	RAS Pump House (RAPU):
a)	L	RAS Pumps.
b)	L	SECL 9 and 10 Dewatering Pump.
c)	L	RAPU Sump PUMP 1.
d)	L	RAPU Sump PUMP 2.
CSU-0009	L	Modifications to SLPR Sump Pumps.
CSU-0010	L	Modifications to Tunnel 08 Secondary Effluent Hypochlorite Mixing Pumps. (Incl Residual Analyzer)
CSU-0011	L	Water Quality Monitoring Stations

Commissioning & Start-up Procedure



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CSU Doc#		Title
CSU-0012	S	Polymer System
a)	S	Dry Polymer Systems.
b)	S	Thickening Polymer Mix Tanks, Mixers, and Feed Tanks.
c)	S	Dewatering Polymer Mix Tanks, Mixers, and Feed Tanks.
d)	S	Gravity Belt Polymer Pumps.
e)	S	Centrifuge Polymer Pumps.
CSU-0013	S	Odor Control Exhaust Fans and Biofilter Cells.
CSU-0014	S	Thickening Process
a)	S	Gravity Belt Feed Tanks and Mixing Pumps.
b)	S	Gravity Belt Thickeners (GBT).
c)	S	Gravity Belt Sludge Pumps.
d)	S	Gravity Belt Wash Water Pumps.
e)	S	Thickened Sludge Tanks and Transfer Pumps.
f)	S	Filtrate Tank and Pumps.
g)	S	WAS Flow Control
CSU-0015	S	Dewatering Process
a)	S	Centrifuge Sludge Grinders and Pumps.
b)	S	Centrifuges.
c)	S	Centrate Tank and Pumps.
d)	S	Centrifuge Discharge Conveyors.
e)	S	SOFA Sump PUMP 1.
f)	S	SOFA Sump PUMP 2.
CSU-0016	S	Cake Transfer and Solids Loadout
a)	S	Cake Transfer Conveyors.
b)	S	Truck Hopper Feed Conveyors.
c)	S	Truck Hoppers, Discharge Conveyors, and Discharge Gates.
d)	S	Truck Scales.
e)	S	SOLO Sump 1.
CSU-0017	M	Air Compressors and Dryers.
CSU-0018	M	Sodium Hypochlorite Mix Pumps.
CSU-0019	M	Tunnel Ventilation Monitoring.
CSU-0020	M	RAPU Ventilation Monitoring.
CSU-0021	M	SOFA Ventilation Monitoring.
CSU-0022	M	CW to WWPW Intertie.
CSU-0023	M	Air Handling & HVAC
CSU-0024	M	WWEFC & SI Flow Measurement
CSU-0025	M	Networks
26	M	Fire Alarm
27		Electrical Gear
G=General, M=Monitoring/Misc., L=Liquids, S=Solids		

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2.1.2. Systems Components

The individual system procedures will list or include detailed testing and start-up submittal requirements for each relevant component.

Components comprise every equipment item associated with the project. Example types of equipment, but are not limited to, include:

- Equipment, including pumps, tanks, process treatment equipment, and all other mechanical equipment.
- Operators and Actuators.
- Control Valves; manual and automated.
- Piping and piping appurtenances.
- Electrical system component examples include wiring, panels, MCCs, VFDs and other electrical appurtenances.
- HVAC equipment (fans, air handling units (AHUs), etc.).
- Control system component examples include Human Machine Interfaces (HMI), instruments, instrument networks, process control networks, network communication racks, switches, panels, and monitoring equipment including alarms.

2.1.3. Slough STO-6

Slough and STO6 Facilities will be commissioned independently from the plant operations systems listed in this document. Refer to Specification section 01 91 13, General Commissioning Requirements — Slough Building, for commissioning and facility startup requirements.

2.2 Master Start-up and Testing Schedule

A detailed comprehensive commissioning and start-up schedule has been developed in conjunction with the CM/GC P-6 and PIC schedules and will be maintained throughout the completion of the project.

The plan includes all field testing and startup activities for all equipment including training, types of tests, plans, procedures, dates, etc. with associated activities durations and sequencing for each system as described above in 2.1.1. Each systems' CSU procedure will include the applicable P-6/PIC data.

Each systems' CSU procedure will also include the order for ORT-2 and start-up, and the interconnected relationships of the systems that need to be started up simultaneously.

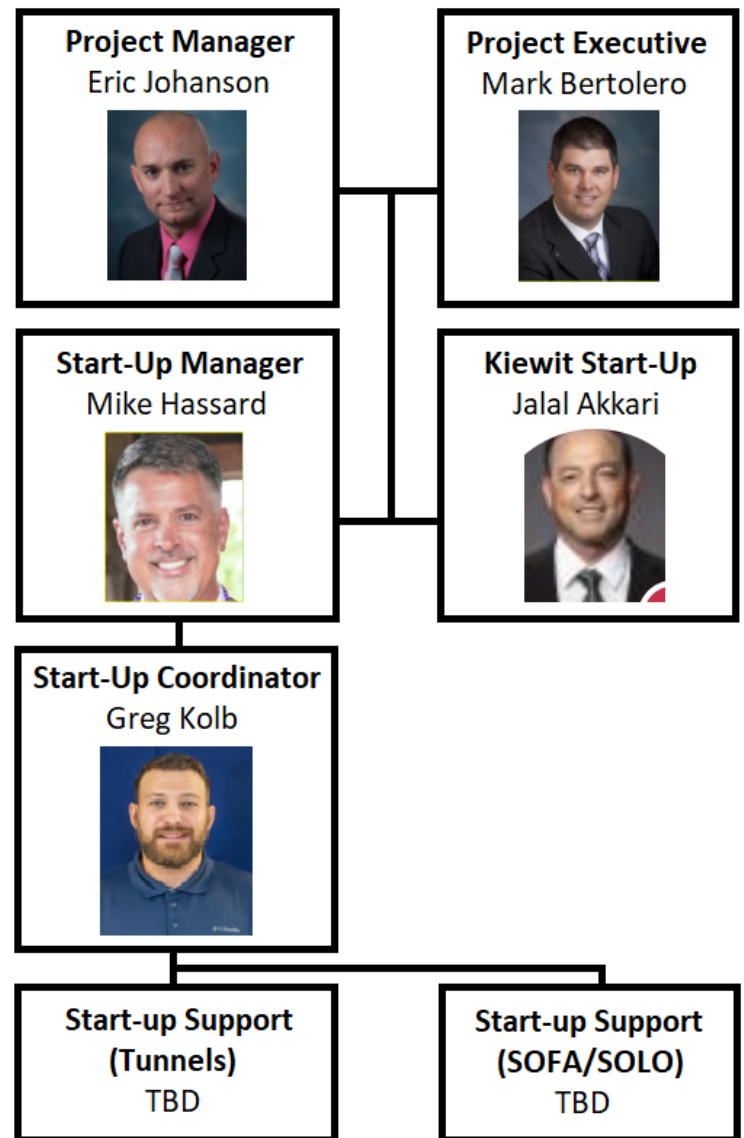
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2.3 Start-up Commissioning Team

The Commissioning and Start-up activities will be managed by Commissioning Managers Michael Hassard and JJ Akkari. Additional Start-up/Commissioning team members including Engineer Greg Kolb and other Kiewit personnel and equipment suppliers to be determined later, will be included with each system procedure.

2.3.1. Stakeholders

The System Commissioning and Start-up procedures will identify the work groups participating: For instance, operations, instrumentation, electrical, HVAC, SCADA are all different work groups that will need to apply resources to the successful testing and start-up of the systems.



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3. Safety

The Columbia Boulevard Wastewater Treatment Plant (CBWTP) Secondary Treatment Expansion Program (STEP) GMP-2 functions under the “CM/CG Site Specific Health and Safety Plan.” Specific safety concerns, warnings, and instructions for commissioning activities related to individual systems can be found in the individual procedures/submittals.

3.1 Health, Safety, and Environment (HSE) Plan

Commissioning is a transition phase in the execution of the project and is a period of elevated risk as new people and new activities are introduced to a site that has been working under a construction regime. Some specific commissioning activities will include line cleaning and pressurization of lines with air, nitrogen, or steam; the operation of utility systems; distribution of electrical power to the field; and finally, the introduction of process fluids/solids. All of these items will be managed via the system procedures in order to comply with the CM/CG Site Specific Health and Safety Plan. All Commissioning personnel will adhere to these additional Commissioning HSE requirements, cautions, and warnings.



Note: This is to provide information, clarifications, guidance, and/or explanations to assist in performing following steps safely and accurately.



CAUTION! This is to alert users to potential equipment damage, critical operating limits, consequences of exceeding those limits, and/or instructions to follow if limits are exceeded!



WARNING! This is to alert users to safety & health hazards and recommended measures to minimize or prevent adverse effects from exposure to hazardous substances or conditions!

During the commissioning phase all workers associated with commissioning activities or working in a commissioning area will undergo a commissioning induction training course.

3.2 LOTO

As described in the Site-Specific Health and Safety Plan, “All energy sources of power-driven equipment shall be locked and/or tagged in the off position (LOTO) when maintenance is being performed.”

In addition to maintenance activities, many commissioning and start-up activities will require LOTO as well. These occasions/activities will be listed in the system specific procedures. LOTO performed for commissioning and start-up activities will comply to the Site-Specific process.

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4. References

4.1 Drawings, P&IDs, Specs

The majority of these will be detailed in the individual submittals.

Number	Document Title
01 75 16	Facility Start-up
01 78 23	Operation and Maintenance Data
01 43 33	Manufacturer's Field Services (Training)
40 90 00	Instrumentation and Controls
23 05 93	Testing Adjusting and Balancing for HVAC
23 52 90	Remote Boiler Plant
NA	CM/CG Site Specific Health and Safety Plan

4.2 Special Tools & Equipment

Due to the nature or location of the work, specialized tool(s) and equipment may be required for the execution of Commissioning and Start-up activities. If so, the individual sub-system CSU procedures will list the specialized tools and equipment.

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5. Phase 1 – Verification of Construction Completion

In Phase 1 commissioning personnel will *verify* the system/sub-system at hand is Mechanically Complete and all construction and installation steps have been verified through the various submittals to the Owner.

These will be detailed in the individual submittals and listed in the System Commissioning Procedures.

5.1 MCOC - Manufacturer's Certificate of Compliance

Manufacturer's Certificate of Compliance (MCOC): Section 01 99 90, Standard Forms has been received by CM/GC prior to shipment and submitted to Owner verifying each of the components of the system meet or exceed the specified parameters.

5.2 MCOFT - Manufacturer's Certificate of Factory Testing

Manufacturer's Certificate of Factory Testing (MCOFT): Section 01 99 90, Standard Forms has been received by CM/GC prior to shipment and has been submitted to Owner verifying the individual equipment tests performed at the factory were performed in accordance with the individual technical specification requirements.

5.3 MCOPI - Manufacturer's Certificate of Proper Installation

Manufacturer's Certificate of Proper Installation (MCOPI), Section 01 99 90, Standard Forms has been submitted to Owner verifying the following:

5.3.1. Component Testing:

Required for all mechanical equipment, other equipment, piping, electrical, instrumentation, controls, and package system equipment. Individual equipment items include fans, pumps, tanks, valves, instruments, motor control centers, local controls, other equipment, equipment control panels, and all items associated with an individual packaged equipment.

5.3.2. Mechanical Installation:

Alignment, balancing, rotation, etc. have been verified to be within manufacturer and contract specifications.

5.3.3. Electrical Installation:

Continuity, meggering, polarity, Hi Pot, etc. have been verified to be within manufacturer and contract specifications (Commissioning of Electrical Systems: Section 26 08 00, Commissioning of Electrical Plans).

5.3.4. Instrumentation:

Instrumentation has been installed correctly and calibration verified to be within manufacturer and contract specifications.

5.3.5. Pipe & Vessel:

Pressure and leak tests, non-destructive inspections, cleaning, and preservation have been performed and verified to be as per manufacturer and contract engineering specifications.

5.3.6. Field Testing:

Component field installation testing shall be completed per the individual Technical Specifications and documented using the standard forms.

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6. Operations & Maintenance (O&M)

Vendors, suppliers, and 3rd party subcontractors will provide Operation and Maintenance (O&M) data, supplies, and training that will be documented and tracked as part of the Commissioning and Start-up process.

6.1 O&M Manuals/Materials Delivery

The Owner will be furnished with any special tools, materials, and supplies required to install, commission, and startup equipment, components, parts, etc. as required by the applicable purchasing specification for the given equipment and overall, by Section 01 78 23, Operation and Maintenance Data. These items should be delivered to CM/GC prior to ORT-1.

Typically supplied O&M materials that CSU personnel will track and verify delivery of include but are not limited to:

- Operation instruction/procedure
- Maintenance instruction/procedure
- Spare parts list/recommendations
- Consumables list/specifications
- Software/e-Data

6.2 O&M Training

In addition to materials above, Vendors, suppliers, and 3rd party subcontractors will also be contracted to provide/perform training compliant with 01 43 33 to Owner's Instrument, Electrical, Mechanical and Operational personnel on the systems/equipment supplied with the goal that Owner's personnel will be capable of assisting in the commissioning, start-up, and maintenance of the plant under the direct supervision of Kiewit CBWTP STEP Commissioning/Start-up Team.

6.2.1. Training Scheduling

O&M training shall be provided as per 01 43 33. Training will be scheduled as per and via the Master Operation and Training Schedule Form, Section 01 99 90, Standard Forms. CM/GC will communicate the O&M training schedule and scope to staff as early as possible to alleviate challenges to scheduling resources.

Training will be scheduled after associated equipment is certified by the manufacturer as properly installed and ready for operation using the MCOPI, and after the equipment is energized and the controlling software is sufficiently complete to run the equipment for which training is being conducted. This is typically after ORT-2 is complete.

6.2.2. Training Requirements

Training programs/modules are to be developed by vendors and typically contain vendor literature, large, detailed drawings, P&ID's, PowerPoint slides and any other visual aids considered useful in support of the module presentation.

Vendor's Training Instructors will deliver lessons using the prepared modules and any visual aids necessary to enhance the presentations. Classroom work will be supported by Field Training for "On the Job," direct experience.

Vendors may be required to provide continued participation throughout Start-up and optimization phase to ensure Owner's complete understanding of O&M requirements of major equipment items.

As per 01 43 33 training sessions will be recorded (audio & video). Recordings, lesson plans, modules, visual aids, and handouts will be submitted to Owner for future operator training/refresher courses.

6.2.3. Training Assessment

At the end of each training program and obtaining the required standard of proficiency, a test will be given to evaluate the performance of the individual persons understanding and an evaluation carried out. The training Instructor, CSU representative, and Owner designee will evaluate the answers selected on the test. Results will be recorded, maintained, and handed over to Owner at the end of the training for verification of O&M Training Complete.

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7. Phase 2 – Commissioning

With construction completion verified and O&M materials delivered, the Kiewit CBWTP STEP Commissioning/Start-up Team will begin static or ‘Pre-commissioning’ activities specified as ‘Operational Readiness Testing 1.’ (ORT-1) which will be followed by Owner’s Engineering leading dynamic or ‘Commissioning’ activities specified as ORT-2.

These will vary by system and will therefore be covered in detail in the System Commissioning and Start-up Procedures and will include:

7.1 ORT 1

During ORT-1, the CM/GC will inspect, test, and document that the work is ready for energization and operation. Testing shall verify completion of the installation, including wiring continuity, terminations, labelling, grounding, and shielding as well as completion and accuracy of documentation and all other work by the CM/GC to verify readiness for operation.

7.2 ORT 2

These works will generally be performed by Engineer and Engineer’s Contractor supported by equipment vendors, PIC system integrator and in some cases, BES. The individual submittals will include verification tests of the process control software and all associated equipment. The test verifies automatic and remote operation of equipment, instrumentation, and controls. Completion ensures the ability to progress to the next phase.

ORT-2 test plans will include but not be limited to:

- Testing Consumables Plan
- List of Control Descriptions
- Water/Air Management Plan

7.3 System Walkthrough

A complete system inspection by the Startup/Commissioning Team and Owner will be performed to determine if the facility is ready for the Start-up Phase. A Punchlist is to be developed by the Owner’s Representative during the system walkthrough and maintained during commissioning to note deficiencies and the correction of these deficiencies.

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8. Phase 3 – Start-Up

With ORT-1 and 2 complete, as well as all phases of O&M training and submittals, CSU personnel will lead Owner's personnel in Phase 3 – Start-up activities. These will vary by system and will therefore be covered in detail in the System Commissioning and Start-up Procedures and will include:

8.1 Process Control Cutover Strategy (CBWTP-CSU-0001.1)

As per 40 90 00 where control over existing or upgraded BES systems transition from current panels and control systems to new or upgraded STEP control, a 'Process Control Cutover Strategy' has been prepared. This strategy will include sequence of start-up and impacts to facility operations including outages and durations as well as addressing process constraints identified in the Construction Constraints Register. Sequence of start-up and sequential system start-ups are addressed in this strategy which will be submitted as document CBWTP-CSU-0001.1.

8.2 Transition Testing Plan

Plan describing how to transition from the usage of the existing BES facilities to the new STEP facilities including the final test to demonstrate new and existing processes operate together as specified.

8.3 Demonstration Testing Plan

The final test of the culmination of all preceding work, the Demonstration test is of a specified duration, during which the Owner initiates process flow through the facility and operates the facility as designed without exceeding defined downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the facility, as evidence of Substantial Completion and Owner's acceptance of operational responsibility of the Project. This test integrates and automatically operates the various elements as a single unit to demonstrate system readiness simulating real process conditions as much as practical. Demonstration Testing will be documented per 40 90 00, Instrumentation and Control for Process Systems, Supplements Instrument Calibration and Data Sheet, and Demonstration Test Sheet.

8.4 Performance Testing Plan

Performance Testing will be performed simultaneously with Demonstration test to demonstrate and confirm individual equipment meets the specified performance requirements.

Performance (and Demonstration) testing shall be completed prior to issuance of Substantial Completion.

In the event that performance testing does not show compliance with the specification, CM/GC will:

- 1) Identify the root cause of the failure to meet specification
i.e. Quality or installation issue, material delay or unavailability or other vendor issue, plant or supporting system performance, change order or design clarification needed, etc.
- 2) Propose remedial action
i.e. RFI, PCO/COR, FO, Submittal, Repair, etc.
- 3) Implement approved proposal
Resulting in:
- 4) Performance meeting specification – or –
Adjustment to specified acceptance criteria allowing acceptance as-is.

8.5 Process Optimization

Process Optimization is intended to provide System manufacturers' services to optimize specific systems, as specified in equipment specifications, to optimize the operation for that specific system after the Demonstration Test Phase. Process Optimization does not impact Performance Testing and, with one exception, shall only be performed after Performance Testing has been successfully completed and Substantial Completion issued. Perform all equipment Process Optimization as per requirements in equipment specifications.

HVAC equipment is the exception and will be tested, adjusted, and balanced (optimized) in conjunction with Performance and Demonstration testing as per 23 05 93 and as detailed in the HVAC CSU Procedure.

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9. Substantial Completion and Warranty Period

The project will be considered substantially complete when testing and commissioning has been completed, applicable training has been provided and Final Operation and Maintenance Manuals have been approved. The CM/GC will notify Owner's Representative that the CM/GC considers the Work, or portions of the Work, to be in Substantial Completion and request for a Substantial Completion or Limited Substantial Completion Inspection. Attached to this notice will be a list of work items that remain to be completed and defective work that remains to be corrected.

Applicable warranty start dates and durations will be documented at this time.

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APPENDIX A:
CSU Process Flowchart

