

**THE NEW SURREY HOSPITAL
AND
BC CANCER CENTRE PROJECT**

Schedule 1 – Statement of Requirements

Appendix 1L – Commissioning Roles and Responsibilities

APPENDIX 1L - COMMISSIONING ROLES AND RESPONSIBILITIES

Appendix 1L - TABLE 1: Building Systems and Cx Tasks included in Cx process and Level of Involvement

Commissioning Task	Authority	Design-Builder		Building Systems included in Cx process by Cx Provider, and Level of Involvement by Cx Provider																
	Cx Authority	Cx Provider	Consultant & Contractor Roles	LEED Energy-related systems for LEED v4 EAp1 / EAc1 Option 1 Path 1: -Mechanical, including HVAC&R equipment and controls -Plumbing, including domestic hot water systems, pumps, and controls -Electrical, incl. service, distribution, lighting and lighting controls and daylighting controls -Renewable Energy systems	Building Envelope for LEED EAc1 Option 2, Building Envelope Cx	Architectural Systems - Wall assemblies, Floor/ceiling assemblies, Interior space assemblies, Acoustic barriers, Hardware	Vert/Horizontal transportation systems	High Voltage Electrical Service	High Voltage Electrical Distribution (main and branch)	Fire Alarm and Detection Systems	Plumbing Systems - External water distribution, non potable & process water, water purification systems, drainage systems, stormwater connections	Fire Protection Systems	Emergency Generator/ATS	UPS	Electronic Safety & Security - Access Control System, Wireless Staff Duress System, Fixed Duress System, Intrusion Detection System, Intercommunications System, IP Video Surveillance System, Clinical Observation Camera System, Patient Wandering System	Communications (Division 27)	Health Care Facility Integrated Systems and Controls	M&V Energy Metering	Owner Supplied Equipment and Clinical Cx	
30% Phase																				
Review OPRs	L	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Confirm Cx Roles and Responsibilities	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Develop BOD	R	R	L	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Develop Initial Cx Plan Outline	R	L		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Develop Initial Cx Schedule	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Hold 30% Phase Cx Meetings	P	L		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Identify Project Specific Cx Responsibilities	R	L		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Design & Construction Documents Phases																				
Update BOD, including narrative descriptions of all systems	R	P	L	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Verify OPR & BOD for completeness & clarity	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Perform Cx focused reviews of output drawings and specifications and report directly to Owner. Cx focused reviews shall also include review of the Facility infrastructure's ability to serve Owner supplied equipment.	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Meet with Authority to relay findings from Cx focused reviews of output drawings and specifications	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Plan/Prepare Sample and Draft Cx Process Tracking Tool, Verification Checklists, and Test Procedures	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Plan/Prepare Draft Systems Integration Checklists and Test Procedures	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Plan/Prepare Draft Integrated Life Safety Systems Test Plans (ULC S1001) and Integrated Systems Operational Test Plans (ISOT).	L	P	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Define Requirements for Systems Manuals	R	R	L	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Define Requirements for Operations and Maintenance Manuals	R	R	L	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Determine Operational Training requirements	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Develop Cx specifications	R	L	L	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Update Cx Schedule	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Update Cx Plan	R	L		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Construction Phase																				
Integrate Cx activities into project schedule	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Participate in Construction phase kickoff and progress meetings	P	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Review Contractor submissions and shop drawings from a Cx perspective. Installation and operations manuals (IOMs) shall be included with shop drawing submissions and reviewed by the CxP. Ensure that shop drawings for any approved alternate equipment are also reviewed by the CxP.	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	

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Construct Mock-ups	P	P	L	yes	yes	yes														
Update OPR & BOD review if appropriate at this time.	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	
Update Cx Plan to include final equipment selections.	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Conduct regular Commissioning meetings with all applicable contractors and consultants present. Ensure sufficient notice is provided to the Owner for Owner participation in these meetings.	P	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Prepare detailed Commissioning schedule clearly identifying dates for static verification, start-up, functional performance and integrated system testing. The schedule will include duration of tasks and critical path items required to proceed with Commissioning tasks.	R	P	L	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Perform & Document static verification	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Perform & Document start-up	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Perform & Document functional performance testing	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Perform & Document Dry Run Integrated Life Safety Systems Testing per CAN/ULC S1001 for Fire Protection and Life Safety Systems and CSA-Z8001, and Dry Run Integrated Systems Operational Testing (ISOT).	R	L	P	yes	yes		yes			yes				yes	yes	yes				yes
Perform & Document Integrated Systems Testing per CAN/ULC S1001 for Fire Protection and Life Safety Systems and CSA-Z8001, and Integrated Systems Operational Testing (ISOT).	L	P	P	yes	yes		yes			yes				yes	yes	yes				yes
Prepare and Update Issues Logs	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Resolve Issues resulting from Tests	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Review Operations and Maintenance Manual	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Review Systems Manual	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Prepare Owner Training Agenda and Materials and submit at least 4 weeks prior to proposed Training date	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Demonstration to Owner	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Verify, Review & Conduct Training	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Prepare Cx Report	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Prepare Cx Manual	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Prepare Current Facilities Requirements and Operations and Maintenance Plan	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Occupancy & Operations Phase																				
Resolve outstanding Cx issues	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Perform seasonal/ deferred testing	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

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Perform Monitoring Based Cx analysis (quarterly, at minimum)	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Resolve Issues Resulting from Seasonal/deferred tests	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Update Issues Logs resulting from seasonal/deferred tests	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Perform Warranty review	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Close-Out Phase																			
Complete Final Cx Report	R	L	P	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Acceptance	L																		

NOTES:

- The list of building systems included is based on CSA Z8001, Table 1 (modified) and is not intended to be exhaustive. Design-Builder will ensure that all CSA Z8001 systems applicable to the Project are included in the Commissioning process, even if not listed here.
- L = Leads/Responsible, R = Review (subject to Review Procedure), P = Participates

Appendix 1L - TABLE 2: High Level Cx Milestone Tasks and Prerequisite Cx Activities

The following table provides an illustration of the expected sequential operation of various commissioning milestone activities intended to ensure meaningful engagement opportunities for the Authority. The table is not intended to be an exhaustive list of commissioning tasks or a detailed list of all the construction and testing and balancing activities, or the building and system readiness requirements that are necessary to complete commissioning. The construction, testing and balancing, building and system readiness requirements will need to be included in the commissioning schedule.

Commissioning Milestone Task	Prerequisite Commissioning Activity
Owner Project Requirement (OPR) Review	Owner prepares OPR
Basis of Design (BOD) Review	Designers prepare (and update) BOD
Initial Design Review	Designers prepare initial design
Cx Plan Outline	
Follow up Design Reviews	<ul style="list-style-type: none"> - CxP has met with Authority to review previous Design Review comments. - Initial Cx Design Review comments addressed. - Designers update drawings and specifications.
Cx Plan Development during design- which also includes preliminary versions of the following for Authority Review: <ul style="list-style-type: none"> - Cx schedule, - installation and start-up checksheets, - functional performance test procedures - integrated test procedures - training requirements 	During the design stage of the project the Cx Plan development will follow the iterative design process and get updated to reflect the updated design documents, schedule planning, and contractors joining the team.
Shop Drawing Review	Contractors submit shop drawings.
Update of Cx Plan - which also includes final versions of the following for Authority Review: <ul style="list-style-type: none"> - Cx schedule, - installation and start-up checksheets, - functional performance test procedures - integrated test procedures - training requirements 	Shop drawings approved.

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Commissioning Milestone Task	Prerequisite Commissioning Activity
Pre-functional/Installation Documentation	<ul style="list-style-type: none"> - Any commissioning related issues noted from shop drawing reviews resolved. - Installation check sheets approved by Authority.
Start up Verification	<ul style="list-style-type: none"> - Start up check sheets approved by Authority. - Adequate advanced notice for Start ups dates provided to Authority. - Any commissioning related issues noted from Installation Documentation resolved. - Completed Installation check sheets reviewed by CxP and verified on site by CxP.
Functional Performance Testing	<ul style="list-style-type: none"> - Functional Performance Test Procedures approved by Authority. - Adequate advanced notice for Functional Performance Testing dates provided to Authority. - Any commissioning related issues noted from Start up Verification resolved. - Completed Startup sheets reviewed by CxP and verified on site by CxP.
Integrated System Testing	<ul style="list-style-type: none"> - Integrated Test Procedures approved by Authority. - Adequate advanced notice for Integrated System Testing dates provided to Authority. - Any commissioning related issues noted from Functional Performance Testing resolved. - Completed Functional Performance Test Reports reviewed by CxP and verified on site by CxP.
Owners Demonstration and Training	<ul style="list-style-type: none"> - All issues affecting system performance resolved. - Systems Manual and O&M Manual reviewed by CxP. - Training agendas and materials approved by Authority.

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Commissioning Milestone Task	Prerequisite Commissioning Activity
Thirty (30) Day Demonstration Period	<ul style="list-style-type: none"> - Six (6) month Commissioning and stabilization period of Energy Centre. - Mechanical and electrical plant and associated Building Systems required to service the Facility will be installed, Commissioned, and performing in accordance with the requirements set out in the Agreement. - The Authority will be trained and equipped with required documentation to operate and maintain the completed Energy Centre. - All the Authority's wired and wireless Information Technology (IT) and communications infrastructure required to Commission the Energy Centre and integrate it to the Site as well as enable the Facility Management Staff to operate the Energy Centre will be installed, Commissioned, and performing in accordance with the Authority's Project Requirements and specifications

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TABLE 3: COMMISSIONING RESPONSIBILITIES TRACKING (NOTE: This table is provided as an example and is to be completed and further developed in the first draft of the Commissioning Plan and updated thereafter.)

System	Responsible Design-Builder Consultant	Design-Builder CxP Design Review Complete? (Y/N)	Trade	Design-Builder CxP Pre-functional Test Review Complete? (Y/N)	*Responsible Commissioning Representative from Design-Builder	Installation Predecessors (key requirements for Cx of this Equipment / System)	Installation Successors (key systems enabled as a result of successful Cx of this equipment /system)	Tests Required (Can provide reference to Schedule 1 Section)	**Minimum CxP Sampling Rate for Functional Testing	Formal Demonstration to Design-Builder's Design Professional Engineer of Record Required 5.6.12.4(5)	Design-Builder CxP Review and Witness of Functional Tests Complete? (Y/N)	Date of Design-Builder CxP Review and Witness of Functional Tests	Authority Review and Witness of Functional Tests Complete? (Y/N)	Design-Builder CxP Review and Witness of Integrated System Tests Complete? (Y/N)	Date of Design-Builder CxP Review and Witness of Integrated System Tests	Authority Review and Witness of Integrated System Tests Complete? (Y/N)	Demonstration to EoR Complete?
Mechanical, HVAC, General								Cx Checklists									
Hot Water Heating Plant & Components									100%	Yes							
Chilled Water Plant & Components									100%	Yes							
Process Cooling System									100%	Yes							
Heat Recovery System & Components									100%	Yes							
Condenser Water System & Components									100%	Yes							
Domestic Hot Water Generation									100%	Yes							
Hot Water Sterilization									100%	Yes							
Reverse Osmosis Systems																	
Medical Gas Systems (O2, CO2, N2, NO, Air, Vac)																	
Pneumatic Conveying System									20%								
Lab Instrumentation Air System (Gas, N2, Air)																	
Water Distribution Systems (including vendor supported mechanical coupling systems)																	
PRVs - Verification of accessibility, identification, and pressure settings									100%								
Booster and Recirc Pumps																	
DCW																	
DHW tanks, pumps and controls										Yes							
Tempered Water								Testing of supply water temperature from all Master and Zone Tempering Valves / TMV	100%								
Irrigation & make-up water (include greywater reclaim components)																	
Aeration																	
UV system									100%								
Pumping System																	
Drainage System																	
Sump Pumps									100%	Yes							
Sanitary Ejectors																	
Separators (grease, oil, solids)																	
Condensate (non-steam)																	
Acid Neutralizers																	
Specialty Drainage – Hemodialysis									100%								
Rainwater Harvesting									100%								
Sanitary Storage alarms, pumps									100%								
Plumbing venting system																	
Fire Pumps									100%	Yes							
Fire Suppression - Wet Systems, Dry Systems								CxP check correct sprinkler heads used	10%	Yes							
Fire Suppression - Pre-Action								CxP check correct sprinkler heads used	10%	Yes							
Fire Suppression - Clean Agent									100%	Yes							
Air Supply																	
Storage Tank																	
Fire Alarm integration									100%	Yes							
Heat Tracing									100%								
Zone Valves																	
Kitchen Fire Suppression																	
Smoke Control System									100%	Yes							
Stair Pressurization									100%	Yes							
Smoke Evacuation									100%	Yes							
Zone Level Smoke Control (Under all Modes of Operation)									100%	Yes							
Inpatient Area / Areas of Refuge / Containment									100%								
Integration with BMS and Life Safety Systems / Fire Alarm Panel									100%								
Diesel Systems (for Generators) – primary storage, day tanks, transfer pumps, monitoring system, fill system									100%	Yes							
Measurement & Verification									100%								
All Meters									100%								
BMS Controls																	
Integration of BMS and Life Safety									100%								
Archiving									100%								
Fault Detection and BMS intergration									100%								
Exhaust Systems																	
General Exhaust / Relief																	
Process / Fume Exhaust Systems (perchloric, radioactive, etc.)									100%								
Contamination Exhaust									100%								
Kitchen Exhaust																	
Parking Exhaust incl. CO Monitoring and Control of the Exhaust System									100%								
Negative Air Exhaust System									100%								
Lab Exhaust									100%	Yes							
MDRD Exhaust									100%								
Generator									100%	Yes							
Chiller Room									100%								
Smudging Exhaust System in deacidated locations									100%								
Fume Hood Certification																	
AHU's									100%	Yes							
Packaged Supply Air Equipment									100%								
Clean room Systems									100%	Yes							
MAU's									100%								
Rooftop Packaged Systems									100%								
Air Filtration Systems																	
Testing of all Filtration Systems																	
HEPA, Carbon, etc.																	
Humidification									100%								
PRV's, RBPB's, DCVA's, safety relief valves,																	
Terminal Units, (VAV's, FCU's, Split Systems, Rad. Panels, FFH's, UH's, BBH's, etc.)									50%								
Pressurization (Zone pressurization, room pressurization, Clean rooms, etc.)									100%								
Renewable Energy Systems									100%	Yes							

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Zone Level Smoke Control under all Modes of Operation									100%								
Smoke Control - Patient areas									100%								
Smoke Control - Areas of Refuge and Containment									100%								
Filtration								HEPA filter testing									
Pneumatic Conveying System									25%								
Building Pressurization									100%	Yes							
Clean room systems, Pharmacy - Airborne testing									100%								
Emergency Service Connections									100%								
Division 25																	
Integrated Building Management Platform (IBMP)								IBMP data point aggregation Power loss test Integration commissioning	100%	Yes							
FMO Network and Infrastructure								Fiber, copper Fluke testing Network hardware commissioning									
Equipment Alarms								Manufacturer commissioning BMS integration commissioning IBMP integration commissioning									
Building System Alarms								Manufacturer commissioning BMS integration commissioning IBMP integration commissioning	25%								
Division 27																	
Common Works								Communications room equipment commissioning UPS power test									
Structured Cabling								Fiber, copper Fluke testing									
Data Network								Base network connectivity commissioning Network hardware commissioning Power loss test									
Wireless Network								Active Site Survey Network hardware commissioning									
VoIP System								Commissioning by Owner									
End Use Equipment								Commissioning by Owner									
Audio-Visual / Multimedia Systems								Manufacturer specific commissioning Connectivity commissioning Programming commissioning	25%								
Patient Physiological and Vital Signs Monitoring System								Base network connectivity commissioning Hardware commissioning Power loss test									
Distributed Antenna System (DAS)								Active Site Survey Network hardware commissioning									
Location Services (RTLS)								Manufacturer recommended commissioning Site Survey to verify all zones Hardware commissioning Integration commissioning	50%	Yes							
Public Address System								Hardware commissioning Site survey to verify sound levels Integration commissioning	25%								
Nurse Call Systems								Hardware commissioning Power loss test Integration commissioning	100%								
Integration Engine								Power loss test Software commissioning Integration commissioning	100%								
Division 28																	
Access Control System								Hardware commissioning Programming commissioning Integration commissioning	100%								
Wireless Panic Duress System								Hardware commissioning Programming commissioning Site survey to verify zone accuracy Integration commissioning	100%								
Fixed Duress System								Hardware commissioning Integration commissioning	100%								
Intrusion Detection System								Hardware commissioning Integration commissioning	25%								
IP Video Surveillance System								Hardware commissioning Power loss test Integration commissioning									
Patient Wandering System								Hardware commissioning Integration commissioning	25%								
Clinical Observation Camera System								Hardware commissioning Programming commissioning									
Intercommunications System								Hardware commissioning Integration commissioning									
Fire Alarm										Yes							
Power Distribution Equipment								Power distribution equipment commissioning -Rotation checks -Insulation resistance testing -Contact resistance testing									
Lighting								Lighting controls commissioning Lighting levels testing (spot checks)	25%								
Electrical Rooms								N/A									
Equipment Replacement Strategy								N/A									
Zoning								N/A									

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System	Responsible Design-Builder Consultant	Design-Builder CxP Design Review Complete? (Y/N)	Trade	Design-Builder CxP Pre-functional Test Review Complete? (Y/N)	*Responsible Commissioning Representative from Design-Builder	Installation Predecessors (key requirements for Cx of this Equipment / System)	Installation Successors (key systems enabled as a result of successful Cx of this equipment /system)	Tests Required (Can provide reference to Schedule 1 Section)	**Minimum CxP Sampling Rate for Functional Testing	Formal Demonstration to Design-Builder's Design Professional Engineer of Record Required 5.6.12.4(5)	Design-Builder CxP Review and Witness of Functional Tests Complete? (Y/N)	Date of Design-Builder CxP Review and Witness of Functional Tests	Authority Review and Witness of Functional Tests Complete? (Y/N)	Design-Builder CxP Review and Witness of Integrated System Tests Complete? (Y/N)	Date of Design-Builder CxP Review and Witness of Integrated System Tests	Authority Review and Witness of Integrated System Tests Complete? (Y/N)	Demonstration to EoR Complete?	
Integrated Controls for High Voltage Equipment in the Energy Centre								Demand response / load management / energy management systems commissioning High voltage integrated controls system commissioning Generator synchronization / paralleling commissioning Closed transition transfer switch commissioning, including relay commissioning and BC Hydro approval Redundant control system PLC fail-over demonstration Demonstration of operation in tie-breaker off-nominal configurations	100%	Yes								
Provisions for Future								Summary report of actual peak demand loads in first year of operation (on each metered panel/distribution equipment), confirmation of required spare capacity.										
Protective Device Co-ordination								Confirmation of coordinated setting implementation and relay commissioning										
Arc Flash Hazard Reduction								Arc flash reduction systems commissioning (ZSI, maintenance modes, remote racking, arc detection relays etc.)										
Power Quality								Summary report of power quality measurements in first month of operation (on each metered point in the system), confirmation that required metrics achieved.	100%									
Magnetic Field Strength								Magnetic field testing (spot checks)										
Utility Power																		
Emergency Power								C282/Z32 testing, failure (e-stop) test	100%									
High Voltage Distribution								Feeder hi-pot testing										
Buried Duct Bank System for Campus Distribution								Confirm adequate drainage										
Distribution Equipment - 600 Volts and Below								Equipment commissioning										
Uninterruptible Power Supply (UPS) System								Alarms/remote monitoring Equipment commissioning Verify backup time and kW capacity (for spare calc) including comm ATS/dual supply switched to UPS [IMIT tested as soon as Wi-Fi operational, Clinical/IMIT UPS both tested at 6-months in-service] Verify wrap-around backup connection Must be commissioned before servers / switches connected	100%	Yes								
Metering								After loads energized Loads by department End use categories Integrations to BMS, VFD, lighting, IBMP	100%									
Wiring Methods, Materials, Devices								Z32										
Raceways																		
Grounding and Bonding								Soil resistivity test (Wenner or soil analysis) Ground Grid Fall-of-Potential Test Z32										
Seismic Requirements for Electrical System								N/A										
Lighting																		
Lighting Control System								Confirm zoning, addressing, levels, etc. as per design/shop drawings Colour tuning if specified Integrations testing as per integration sections	25%	Yes								
Mechanical Equipment Connections																		
Clock System								Confirm full signal coverage & all operational										
Electric Vehicle Chargers								Commission including network access & load management & demand response & payment systems	20%									
Elevators								Elevator sign-off, integration testing	50%	Yes								
Envelope Systems																		
Roofing								Electronic leak detection test.										
Punched Windows								Window leak testing: ASTM E 1105.										
Thermal Bridging								Thermal scanning										
Curtain Wall incl. spandrels and doors																		
Cladding																		
Air Barrier								Air leakage testing whole-building. ASTM E 779										
Below Grade Waterproofing																		
Envelope Mock-ups																		
Envelope Performance Testing									20%	Yes								
Door Hardware (Non-Access Control)									20%									
Kitchen Equipment																		
Acoustics																		
Sound isolation between spaces								ASTC / NIC testing - to happen as soon as first walls are boarded and sealed.										
Background Noise								After mechanical equipment up and running and balanced.										
Reverb Time Tests								Key spaces - conference rooms, classrooms										
Speech Privacy Tests																		

APPENDIX 1L - COMMISSIONING ROLES AND RESPONSIBILITIES

TABLE 3: COMMISSIONING RESPONSIBILITIES TRACKING (NOTE: This table is provided as an example and is to be completed and further developed in the first draft of the Commissioning Plan and updated thereafter.)

System	Responsible Design-Builder Consultant	Design-Builder CxP Design Review Complete? (Y/N)	Trade	Design-Builder CxP Pre-functional Test Review Complete? (Y/N)	*Responsible Commissioning Representative from Design-Builder	Installation Predecessors (key requirements for Cx of this Equipment / System)	Installation Successors (key systems enabled as a result of successful Cx of this equipment /system)	Tests Required (Can provide reference to Schedule 1 Section)	**Minimum CxP Sampling Rate for Functional Testing	Formal Demonstration to Design-Builder's Design Professional Engineer of Record Required 5.6.12.4(5)	Design-Builder CxP Review and Witness of Functional Tests Complete? (Y/N)	Date of Design-Builder CxP Review and Witness of Functional Tests	Authority Review and Witness of Functional Tests Complete? (Y/N)	Design-Builder CxP Review and Witness of Integrated System Tests Complete? (Y/N)	Date of Design-Builder CxP Review and Witness of Integrated System Tests	Authority Review and Witness of Integrated System Tests Complete? (Y/N)	Demonstration to EoR Complete?
Sound Masking								Cx by vendor/supplier									
OITC = Outdoor-Indoor Transition Class testing																	
Medical Equipment - to be developed further by Design-Builder with input from the Authority.																	

* Although the Commissioning Provider is responsible for the commissioning of all systems, it is understood that commissioning of some specific systems will be undertaken by system specific Commissioning Agents or Specialists and will be reviewed and witnessed by the Commissioning Provider and included in the Commissioning process (reviews, testing, schedules, reporting, etc.).

** CxP sampling rates for functional testing of identical or near identical pieces of equipment will be as defined in this table at a minimum. For Equipment / systems in which a minimum sampling rate is not identified, CxP sampling rate will be in line with table ASHRAE Guideline 1.1 Annex N Table for Final Commissioning Process Testing.