THE CITY OF WINNIPEG

DESIGN BUILD OF NORTH END SEWAGE TREATMENT PLANT UPGRADE: HEADWORKS FACILITIES

DESIGN BUILD AGREEMENT

SCHEDULE 18 – TECHNICAL REQUIREMENTS

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A.1 Introduction

A.1.1 Technical Content

A.1.1.1 This section covers the general technical requirements applicable to all management systems and plans and the Work of the Project. The information in the Technical Requirements or as amended over the life of the Project, is organized as follows:

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A.1.2 Order of Precedence

A.1.2.1 In the event of ambiguities, conflicts or inconsistencies between or among and of the provisions of this Schedule 18 and its appendices, the provisions shall govern in the following order of precedence with each taking precedence over those listed subsequently:

(a) the provisions of amendments in writing to the Technical Requirements signed by the Parties and Change Orders shall govern and take precedence only over those specific provisions of these Technical Requirements expressly amended thereby;

(b) any provision establishing a higher standard of safety, reliability, durability, performance or service shall take precedence over a provision establishing a lower standard of safety, reliability, durability, performance or service;

(c) Schedule 18 Section A General

(d) Schedule 18 Section C Design Requirements

(e) Appendix 18A – Process Functional Requirements;

(f) Appendix 18Q – Control Room Requirements;

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(i) Appendix 18M – Classification of Loads;

(j) Appendix 18D – City Standards;

(k) Appendix 18U – Process Mechanical Design Guide

(l) Schedule 18 Section D Construction;

(m) Schedule 18 Section E Training, Commissioning and Testing;

(n) Schedule 18 Section F Substantial Completion;

(o) Schedule 18 Section G Close-out;

(p) Appendix 18P – Coordination Protocol;

(q) Appendix 18R – Process Performance Guarantees;

(r) Appendix 18E – Standardized Goods;

(s) Appendix 18G – Training Requirements;

(t) Appendix 18F – O&M Information;

(u) Appendix 18H – Asset Registry;

(v) Appendix 18C – Drafting Requirements;

(w) Appendix 18N – Design Submittal Requirements;

(x) Appendix 18J – Room Data Sheets;

(y) Appendix 18S – Geotechnical Investigations;

(z) Appendix 18B – Specifications;

(aa) Schedule 18 Section B Management of the Project; and

(bb) Appendix 18T – Document List.

A.1.3 Conflict in Technical Requirements

A.1.3.1 In the event of any conflict or inconsistency between the sections/appendices of these Technical Requirements, such conflict or inconsistency shall be resolved on the basis that provisions shall be given priority depending on their source in accordance with and in the priority and order listed in Section A.1.2.

A.1.3.2 Design Builder shall notify the City immediately if it discovers any conflict between any provisions of Schedule 18 including its appendices.

A.1.3.3 In the event of any conflict or inconsistency between the sections/appendices of these Technical Requirements, which is not resolved in accordance with Section A.1.2 of this Schedule 18, Design Builder shall issue a RFI for City review in accordance with Section A.5.1 of this Schedule 18.

A.1.4 Reference Rules

A.1.4.1 References to section numbers in this Schedule are to section numbers of these Technical Requirements, unless expressly provided otherwise.

A.1.4.2 References to Schedules in this document are references to Schedules in the Design Build Agreement, unless expressly provided otherwise.

A.1.4.3 References to any standards, publications, policies, guidelines or other requirements in the sections/appendices of these Technical Requirements are to the standards, publications, policies, guidelines or other requirements that were in place as of the Submission Deadline.

A.1.5 Definitions

A.1.5.1 In this Schedule 18 – Technical Requirements, capitalized terms shall have the corresponding meaning as set out in Schedule 1 – Definitions and Interpretation or as defined below:

(1) "**30% Design Submittal**" has the meaning set out in Section C.1.3.16 of this Schedule 18;

(2) "**60% Design Submittal**" has the meaning set out in Section C.1.3.17 of this Schedule 18;

(3) "**90% Design Submittal**" has the meaning set out in Section C.1.3.18 of this Schedule 18;

(4) "**Administration Building**" means the existing building that is used by plant staff for administrative purposes;

(5) "**Annual Average Flow**" or "**AAF**" means the total volume in a year divided by the number of days in that year to give a volume per day;

(6) "**Apparent Sound Transmission Class**" or "ASTC" means the field measurement of the Sound Transmission Class, which typically returns results 5-8 points lower than the formal laboratory Sound Transmission Class rating;

(7) "**Area Code**" means the single character from A to Z that represents a physical area or building in which equipment is located;

(8) "**Area Manual**" has the meaning indicated in Section E.7.1 of Appendix 18F – O&M Information;

(9) "**Area Control Room**" has the meaning indicated in Section E.1.1 of Appendix 18Q – Control Room Requirements;

(10) "**As-Built Construction Drawings**" has the definition of "as-builts" as described by the relevant professional association in Manitoba (e.g. as defined by the Authentication of Hardcopy and Electronic Documents published by Engineers

Geoscientists Manitoba) and means the reproduction of all drawings showing all relevant details and changes of the Infrastructure from that shown in the IFC drawings and any subsequent Post IFC Revisions including horizontal and vertical alignments, cross-section elements, plan views, details, notes, etc.;

(11) "**As-Built Construction Reports**" has the meaning set out in Section G.2.1.1 of this Schedule 18;

(12) "**As-Built Construction Specifications**" means the reproduction of all Specification Sections providing all relevant details and changes of the Infrastructure from that described in the IFC specifications and any subsequent Post IFC Revisions. This shall include providing the specific products and models incorporated into the Infrastructure.

(13) "**As-Built Project Schedule**" has the meaning indicated in Section G.2.4 of this Schedule 18;

(14) "**As-Built Project Submittal**" means the Submittal that captures as-built information after Substantial Completion and includes all documents set out in Appendix 18N – Design Submittal Requirement;

(15) "**Asset**" means any equipment or physical entity that requires operational or maintenance work to be completed during its useful life;

(16) **"Asset Class"** means a sub-grouping of Asset Class Type. An Asset Class is a group of assets which have a common operational philosophy and share a common purpose, for example: pumps, compressors. In OWAM, the Asset condition scoring model is defined within the Asset Class and can be applied to all Assets assigned to that Asset Class. This structure allows for multiple Asset Classes to exist within an Asset Class Type where different Asset condition scoring models can be applied to each Asset Class;

(17) "**Asset Class Type**" means a group of Asset Classes that share some common characteristics;

(18) "**Asset O&M Information**" has the meaning indicated in Section C.1.1 of Appendix 18F – O&M Information;

(19) "**Asset Registry**" has the meaning indicated in Section B.1.1 of Appendix 18H – Asset Registry

(20) "**Asset Specification Template**" means the Microsoft Excel template, associated with a specific Asset Type, for use by Design Builder in completing the Asset Registry. The template is formatted for the provision of the required fields and attributes associated with each Asset;

(21) "**Asset Type**" means a sub-category within an Asset Class. In this way, Assets are further grouped according to their principles of operation and assembly. For example, Centrifugal Pump is an Asset Type with the Asset Class of Pumps;

(22) "**Certificate of Compliance**" means a certificate issued by Governmental

Authority to confirm that contamination on the Lands has been satisfactorily remediated;

(23) "**Certificate of Operations Advisory Services Completion**" has meaning set out in Section G.3.4.2.1;

(24) "**Certificate of Performance Testing Completion**" has the meaning set out in Section E.3.6.6.1(a) of Schedule 18;

(25) "**Certificate of Systems Operational Testing Completion**" has the meaning set out in Section E.3.5.10.2(a) of Schedule 18;

(26) "**Certificate of Training Completion**" has the meaning indicated in Section D.2 of Appendix 18G – Training Requirements;

(27) "**City Standards**" means the standards and guidelines set out in Appendix 18D – City Standards;

(28) "**Commissioning Plan**" has the meaning in Section E.2.2.1 of Schedule 18;

(29) "**Commissioning Lead**" has the meaning indicated in Section E.1.3.2.1 of Schedule 18;

(30) "**Commissioning Records**" has the meaning indicated in Section C.4.1 of Appendix 18F – O&M Information;

(31) "**Commissioning Phases**" has the meaning indicated in Section E.3.1.1 of Schedule 18;

(32) "**Commissioning Quality Management Plan**" means the plan described in Section B.6.1.5.1 of Schedule 18;

(33) "**Communications Management Plan**" means a component of the Project Management Plan that describes how, when and by whom information about the Project will be administered and disseminated;

(34) "**Community Impact Mitigation Management Plan**" has the meaning set out in Section D.2.3.1 of Schedule 18;

(35) "**Construction Commencement Conditions**" has the meaning set out in Section D.1.7.1;

(36) "**Construction Management Plan**" has the meaning set out in Section D.2.1.1 of Schedule 18;

(37) "**Construction Quality Management Plan**" means the plan described in Section B.6.1.4.1 of Schedule 18;

(38) "**Control Room Operator Workspace**" has the meaning indicated in Section C.1.1 of Appendix 18Q – Control Room Requirements;

(39) "**Certificate of Recognition**" or "**COR**" means a valid Manitoba Certificate of Recognition and Letter of Good Standing (or Manitoba equivalency) as issued under the Certificate of Recognition (COR) Program administered by the Manitoba Construction Safety Association of Manitoba or by the Manitoba Heavy Construction Association WorkSafely™ COR™ Program;

(40) "**Cost Management Plan**" means a component of the Project Management Plan that establishes the criteria and the activities for developing, monitoring and controlling costs;

(41) "**Course Lesson Plan**" has the meaning indicated in Section B.3.1 Appendix 18G – Training Requirements;

(42) "**Decibel A-rating**" or "**dBA**" means a weighted sound pressure level within a space adjusted based on human hearing systems (e.g. less sensitive to low frequencies) in accordance with IEC 61672;

(43) "**Decommissioning Plan**" has the meaning indicated Section C.2.4.1 of Schedule 18;

(44) "**Demobilization**" means the removal of all equipment, supplies and incidentals from the Lands, including those necessary for securing, signing, movement and staging and establishment of offices, buildings and other facilities necessary for the Work and includes the restoration of the Lands to their original condition prior to Mobilization;

(45) "**Design Management Plan**" has the meaning set out in Section C.2.2 of Schedule 18;

(46) "**Design Management Office**" has the meaning set out in Section C.1.4.1 of Schedule 18;

(47) "**Design Phase**" has the meaning set out in Section C.1.2 of Schedule 18;

(48) "**Design Quality Management Plan**" means the plan described in Section B.6.1.3.1 of Schedule 18;

(49) "**Design Submittal**" has the meaning indicated in Section C.1.3.1 of Schedule 18;

(50) "**Design Submittal Review Workshops**" has the meaning set out in Section C.1.7 of Schedule 18;

(51) **Design Team**" means the Project team members set out in B.7.4.1.1 of Schedule 18;

(52) **"Division"** means a collection of Specification Sections that are related to a specific design and construction discipline denoted by a numeral between 1 and 17;

(53) "**Document Management Plan**" has the meaning set out in of Section B.8.2.1 of

Schedule 18;

(54) "**Document Management System**" has the meaning set out in Schedule 13 – Document Management System;

(55) "**Drawing Manua**l" has the meaning indicated in Section G.1.1 of Appendix 18F – O&M Information;

(56) "**Employer**" has the meaning given to "employer" in the WSHA;

(57) **"Environmental Management Plan"** has the meaning as described in Section D.2.4.1 of Schedule 18

(58) "**Environmental Management System**" has the meaning given in Section D.1.8.2 of Schedule 18;

(59) "**Equipment Checkout**" means demonstrating, and providing documentation verifying, that each piece of equipment in a system or sub-system is able to operate for its intended purpose within the applicable system or sub-system, complies with the Technical Requirements and the Final Design and is ready to proceed to Functional Testing;

(60) "**Equipment Checkout Completion**" has the meaning in Section E.3.3.2.1 of Schedule 18;

(61) "**Equipment Lifting and Replacement Plan**" has the meaning set out in C.3.3.1 of Schedule 18;

(62) "**Excavation, Shoring and Dewatering Plan**" means the plan described in Section C.3.5.1 of Schedule 18;

(63) "**Existing Condition**" means the state, existing on the Effective Date, of the following:

i. Any building, structure, utility, amenity, track, roadway or other thing built or constructed on, in, under or over land or water;

ii. Any man-made alteration to a natural geographic feature; and

iii. Any natural geographic feature.

(64) "**Failure Mode and Effects Criticality Analysis**" or "**FMECA**" has the meaning indicated in Section C.5.1 of Appendix 18F – O&M Information;

(65) "**Field Operator Station**" has the meaning indicated in Section F.1.1 of Appendix 18Q – Control Room Requirements;

(66) "**Firm Capacity**" means the capacity of a pumping station or unit process when the largest pump or process unit is out of service;

(67) "**Functional Testing**" means testing to demonstrate, and providing

documentation verifying, that a component, system or sub-system is able to operate for its intended purpose, complies with the Technical Requirements and the Final Design, and is ready to proceed to Systems Operational Testing;

(68) "**Functional Testing Completion**" has the meaning in Section E.3.4.5.1 of Schedule 18;

(69) "**Hauled Liquid Waste**" means the waste from septic tanks, holding tanks, and commercial waste such as wastewater from car wash sump pits.

(70) "**Health, Safety and Security Management Plan**" has the meaning set out in Section D.2.6.1 of Schedule 18;

(71) "**IFC Submittal**" has the meaning set out in Section C.1.3.18.2 of this Schedule 18;

(72) "**Incident Logging Centre**" has the meaning set out in Section B.8.6.1 of Schedule 18;

(73) "**Independent Reviewer**" has the meaning indicated in Section B.6.1.3.1 of Schedule 18;

(74) ""**Inspection and Testing Plan**" has the meaning set out in Section B.6.1.4.1(f) of Schedule 18;

(75) "**Issued for Construction Documents**" or "**IFC**" means the design drawings, Design Data, Technical Specifications and other documents included in the IFC Submittal which have been sealed by the Professional of Record and endorsed as "Received" by the City pursuant to Schedule 5 – Review Procedure;

(76) "**Land Drainage Management Plan**" has the meaning set out in Section C.3.6 of Schedule 18;

(77) "**Lifecycle Cost Management Plan**" has the meaning set out in Section B.5.2 of Schedule 18;

(78) "**Lock Out – Tag Out Procedure**" or **"LOTO"** means a written, specific step by step description of how to physically lock equipment or a process in a de-energized position including the accompanying labelling process for indicating the equipment or process is locked-out;

(79) "**Main Building**" means the existing building that includes the surge well, raw sewage pumps, discharge chamber, and associated equipment and is connected to the existing "Pre-Aeration and Grit Building" via a gallery;

(80) "**Main Control Room**" has the meaning indicated in Section B.1.2.1 of Appendix 18Q – Control Room Requirements;

(81) "**Main Control Suite**" has the meaning indicated in Section B.1.1.1 of Appendix 18Q – Control Room Requirements;

(82) "**Maintenance Building**" means the existing building used by plant staff for maintenance and storage located between the banks of square secondary clarifiers;

(83) "**Maintenance Manual**" has the meaning indicated in Section F.1.1 of Appendix 18F – O&M Information;

(84) "**Maintenance Personnel**" has the meaning indicated in Section B.6.2 of Appendix 18G – Training Requirements;

(85) "**Design Builder's Maintenance Management Plan**" has the meaning set out in Section D.2.8 of Schedule 18;

(86) "**Master Equipment Schedule**" has the meaning set out in Section C4.5.1 of Schedule 18;

(87) "**Maximum Day**" means the highest daily average of the parameter;

(88) "**Maximum Month**" means the maximum 30-day average of the parameter;

(89) "**Mobilization**" means the first occurrence on the Lands of any preparatory works and operations initiated by Design Builder, including those necessary to secure the Lands, to install signage, for the movement and staging of personnel, equipment, supplies, and incidentals on the Lands, for the establishment of all offices, buildings and other facilities necessary for the Work and commencing construction activities on the Lands;

(90) "**Monthly Project Report**" has the meaning set out in Section B.8.5.1 of Schedule 18;

(91) "**NEWPCC Facility Inspection Request**" has the meaning set out in Section C.1.3 of Appendix 18P – Coordination Protocol;

(92) "**NEWPCC Inspection Authorization**" means the permission issued to the Design Builder, by the City, upon acceptance of the NEWPCC Facility Inspection Request, including the items specified in Appendix 18P – Coordination Protocol;

(93) "**NEWPCC Facility Work Request**" has the meaning set out in Section D.1.3 of Appendix 18P;

(94) "**NEWPCC Power Supply Project**" means the power supply upgrade project carried out at the NEWPCC under RFP 599-2015B;

(95) "**NEWPCC Work Authorization**" means the permission issued to the Design Builder, by the City, upon acceptance of the NEWPCC Facility Work Request, including the items specified in Appendix 18P – Coordination Protocol;

(96) "**Noise Control Plan**" has the meaning set out in Section C.3.2.1 of Schedule 18;

(97) "**Noise Criteria**" or "**NC**" means noise criteria as set out in ASHRAE Applications Handbook, Chapter 48. NC is a single number rating that is sensitive to the

relative loudness within a given space at different frequencies;

(98) "**Noise Isolation Class**" or "**NIC**" means noise isolation class. It is a measurement similar to ASTC, but without corrections for room size, and sound flanking;

(99) "**Noise Reduction Coefficient**" or "**NRC**" means noise reduction coefficient as set out in ASTM C423. NRC is a single number rating of the sound absorbing properties of a material – derived by arithmetically averaging the Sabine absorption coefficients at 250 Hz, 1000 Hz, 2000 Hz and 4000 Hz. An NRC of 0.00 indicates zero absorption while; an NRC of 1.00 indicates 100% absorption;

(100) "**Operation and Maintenance Information**" or "**O&M Information**" has the meaning indicated in Section B.1.1 of Appendix 18F – O&M Information;

(101) "**Operations Advisory Lead**" means the individual from the Design Builder's team responsible for performance of the Operations Advisory Services;

(102) "**Operations Advisory Period**" has the meaning set out in Section G.3.1.1 of Schedule 18;

(103) "**Operations Advisory Services**" has the meaning set out in Section G.3.2.1 of Schedule 18;

(104) "**Operations Advisory Services Completion**" has the meaning set out in Section G.3.4.1 of Schedule 18;

(105) "**Operations Manual**" has the meaning set out in Section E.1.1 of Appendix 18F – O&M Information

(106) "**Operations Personnel**" has the meaning indicated in Section B.6.2 of Appendix 18G – Training Requirements;

(107) "**Oracle Work and Asset Management**" or "**OWAM**" means the system utilized by the City and specifically the Water and Waste Department as their computerized work management system;

(108) "**Other Employer**" has the meaning indicated in Section D.7.4.4.1 of Schedule 18;

(109) "**Parcel A**" means Parcel A Plan 56334 WLTO;

(110) "**Participant Evaluation Results**" has the meaning indicated in Section B.17.2 of Appendix 18G – Training Requirements;

(111) "**Performance Testing**" has the meaning set out in Section E.3.6.1 of Schedule 18;

(112) "**Performance Testing Completion**" has the meaning set out in Section E.3.6.5.1 of Schedule 18;

(113) "**Permitting Management Plan**" has the meaning set out in Section C.2.3.1 of Schedule 18;

(114) **"Phase 1 Asset Registry**" has the meaning indicated in Section B.3.2 of Appendix 18H – Asset Registry;

(115) "**Phase 2 Asset Registry**" has the meaning indicated in Section B.3.3 of Appendix 18H;

(116) "**Phase 1 O&M Information**" has the meaning set out in Section B.3.2 of Appendix 18F – O&M Information;

(117) "**Phase 2 O&M Information**" has the meaning set out in Section B.3.3 of Appendix 18F – O&M Information;

(118) "**Post-Construction Condition Assessment**" has the meaning set out in Section D.6.2.5.1(a) of Schedule 18;

(119) "**Post IFC Revision**"" means a revision to the IFC Design Submittal or any subsequent Post IFC Revision that incorporates any changes that would impact or modify the design of that or any other component of Work;

(120) "**Pre-Construction Condition Assessment**" has the meaning set out in Section D.6.2.2.1 of Schedule 18;

(121) "**Pre-Construction Condition Assessment Report**" has the meaning set out in Section D.6.2.3.1 of Schedule 18;

(122) "**Prevention Through Design Plan**" means the plan described in Section C.2.5.1 of Schedule 18;

(123) "**Prime Contractor**" has the meaning given to "prime contractor" in the WSHA;

(124) "**Priority 1 Safety Back-up**" has the meaning indicated in Section A.4.1(a) of Appendix 18M – Classification of Loads;

(125) "**Priority 2 Critical**": has the meaning indicated in Section A.4.1(b) of Appendix 18M – Classification of Loads;

(126) "**Priority 3 Essential**": has the meaning indicated in Section A.4.1(c) of Appendix 18M – Classification of Loads;

(127) "**Priority 4 Non-Essential**": has the meaning indicated in Section A.4.1(d) of Appendix 18M – Classification of Loads;

(128) "**Procurement Management Plan**" means a component of the Project Management plan that specifies procurement approaches and documents project procurement decisions;

(129) "**Professional Engineer**" means an individual who holds a certificate of registration to engage in the practice of engineering in Manitoba under The

Engineering and Geoscientific Professions Act, or any replacement legislation;

(130) "**Professional of Record**" means the architect, engineer, or geoscientist from the Design Team responsible for signing and sealing relevant documents, including IFC documents and for periodic review during construction to ensure compliance with design and relevant codes, all done in accordance with the relevant professional association;

(131) "**Project Management Plan**" means the document that describes how the Work will be executed, monitored and controlled, and closed, including the subsidiary management plans set out in Section B.2.1 of Schedule 18;

(132) "**Quality Management Plan**" means a component of the Project Management Plan that identifies quality requirements and/or standards for the Project and its deliverables, and documents how the Work will demonstrate compliance with quality requirements and/or standards, and more specifically means one of the Design Quality Management Plan, the Construction Quality Management Plan, and the Commissioning Quality Management Plan;

(133) "**Quality Management System**" or "**QMS**" means an organizational structure, procedures, processes and resources necessary to implement a comprehensive, planned and systematic program, designed and implemented by Design Builder pursuant to this DBA, to ensure that the standards of quality control, quality management and quality assurance required by this DBA are achieved by Design Builder in every material aspect of the Works;

(134) "**Record Drawings**" has the definition of "record drawings" as described by the relevant professional association in Manitoba (e.g. as defined by the Authentication of Hardcopy and Electronic Documents published by Engineers Geoscientists Manitoba) and means the reproduction of all drawings showing all relevant details and changes of the Infrastructure from that shown in the IFC drawings and any subsequent Post IFC Revisions including horizontal and vertical alignments, cross-section elements, plan views, details, notes, etc. conforming to the drawing accuracy requirements set out in Section G.2.2.3 of Schedule 18;

(135) "**Related Projects**" means the NEWPCC Power Supply Project and "DCS Migration" and any other project arising that is outside the scope of this DBA;

(136) "**Remediation Management Plan**" has the meaning given in Section D.2.5.1 of Schedule 18;

(137) "**Resource Management Plan**" means a component of the Project Management Plan that describes how physical and human resources will be allocated, managed, assessed and released;

(138) "**Risk Management Plan**" means a component of the Project Management Plan that describes how risk management activities will be structured and performed;

(139) "**Safe Work Procedure**" or "**SWP**" means a written, specific step by step description of how to complete a task safely from start to finish;

(140) "**Schedule Management Plan**" means a component of the Project Management Plan that establishes the criteria and the activities for developing, monitoring and controlling the schedule to meet Substantial Completion and Final Completion;

(141) "**Scope Management Plan**" means a component of the Project Management Plan that describes how the scope of Work will be executed, monitored, controlled and validated;

(142) "**Serious Incident**" has the meaning given to "serious incident" in the Workplace Safety and Health Regulation 217/2006;

(143) "**Simplified P&IDs**" means Process and Instrumentation Diagrams that are simplified to eliminate extraneous information not generally of relevance to plant staff, prepared in accordance with Section E.11 of Appendix 18F – O&M Information;

(144) "**Sound Transmission Class**" or "**STC**" means (laboratory) sound transmission class as set out in ASTM E90. STC is a single number that is an indication of an assembly's ability to block sound (i.e. in the speech frequencies). The higher the STC rating, the higher is the sound transmission loss. For instance: loud speech can be understood fairly well through an STC 30 wall but should not be audible through an STC 60 wall;

(145) "**South End Sewage Treatment Plant**" aka "**SEWPCC**" or "**South End Water Pollution Control Centre**" is the City's sewage treatment plant located on 100 Ed Spencer Drive, Winnipeg, Manitoba;

(146) **"Specification Section"** means an individual numbered specification document relating to a specific item of work within the Division.

(147) "**Standard Construction Specifications**" means the City's standard construction specifications, which includes general requirements, specifications, standard details, and approved products for underground works and surface works.

(148) "**Standard Operation Procedure**" or "**SOP**" means a written set of step-by-step instructions to complete a task in accordance with design and facility requirements. The SOPs provide standardized documented guidance to plant staff for undertaking key operational procedures;

(149) "**Standard Staffing Levels**" means 8 hours per day and 5 weekdays per week;

(150) "**Standardized Goods**" means the respective goods identified in Appendix 18E – Standardized Goods that have been standardized by the City;

(151) "**Standardization Vendor**" means a contractor or supplier of Standardized Goods, as identified in Appendix 18E – Standardized Goods;

(152) "**Subsurface Investigation Plan**" or "**SIP**" has the meaning set out in Section C.3.4.1 of Schedule 18;

(153) "**Systems Operational Testing**" means testing to demonstrate, and providing documentation verifying, that a system or sub-system is able to operate for its intended purpose, without major alarms or shutdowns, is capable of operating under PCS control 24 hours per day for 7 consecutive days and complies with the Technical Requirements, the Final Design and the Commissioning Plan;

(154) "**Systems Operational Testing Completion**" has the meaning in Section E.3.5.9 of Schedule 18;

(155) **"Technical Specifications"** means the entire collection of Specification Sections in all Divisions as provided in Appendix 18B – Specifications;

(156) "**Tie-in or Shutdown Work Plan**" has the meaning in indicated in Section G.1.1 of Appendix 18G – Coordination Protocol;

(157) "**Tie-Ins Plan**" has the meaning set out in Section C.3.7.1 of Schedule 18;

(158) "**Time Impact Analysis**" has the meaning indicated in Section B.4.4.1 of Schedule 18;

(159) "**Training Lead**" has the meaning indicated in Section B.5 of Appendix 18G – Training Requirements;

(160) "**Training Material**" has the meaning indicated in Section B.15.1 of Appendix 18G – Training Requirements;

(161) "**Training Participants**" has the meaning indicated in Section B.6.1 of Appendix 18G – Training Requirements;

(162) "**Training Participant Groups**" has the meaning indicated in Section B.6.2 of Appendix 18G – Training Requirements;

(163) "**Training Participant Register**" has the meaning indicated in Section B.17.4 of Appendix 18G;

(164) "**Training Plan**" has the meaning indicated in Section B.2.1 of Appendix 18G – Training Requirements;

(165) "**Training Program**" has the meaning indicated in Section B.1.1 of Appendix 18G – Training Requirements;

(166) "**Training Records**" has the meaning indicated in Section B.17.1 of Appendix 18G – Training Requirements;

(167) "**Training Schedule**" has the meaning indicated in Section B.4.1 of Appendix 18G – Training Requirements;

(168) "**Training Videos**" has the meaning indicated in Section B.16.1 of Appendix 18G – Training Requirements;

(169) "**Treatment Standards**" has the meaning set out in Section C.4.1.5.1 of

Schedule 18;

(170) "**Water Management Plan**" has the meaning indicated in Section E.2.2.1 of Schedule 18;

(171) "**West End Sewage Treatment Plant**" aka "**WEWPCC**" or "**West End Water Pollution Control Centre**" means the City's sewage treatment plant located on 7740 Wilkes Avenue, Winnipeg, Manitoba;

(172) "**Work Breakdown Structure**" or "**WBS**" has the meaning indicated in Section B.4.2.4 of Schedule 18;

(173) "**WSHA Order**" shall mean/include any improvement order or stop work order made pursuant to *The Workplace Safety and Health Act* (Manitoba);

(174) "**Zone of Influence**" has the meaning set out in Section D.6.2.1.1 of Schedule 18;

A.1.6 Acronyms

A.1.6.1 In this Schedule 18, the following acronyms have the following meanings:

(1)	**ACGIH**	American Conference of Governmental Industrial Hygienists
(2)	**ACI**	American Concrete Institute
(3)	**ASCE**	American Society of Civil Engineers
(4)	**ASHRAE**	American Society of Heating, Refrigeration and Air Conditioning Engineers
(5)	**ASTC**	Apparent Sound Transmission Class
(6)	**ASTM**	American Society for Testing and Materials
(7)	**AWWA**	American Water Works Association
(8)	**CCTV**	Closed-Circuit Television
(9)	**CEC**	Canadian Electrical Code
(10)	**CFD**	Computational Fluid Dynamics
(11)	**CO**	Carbon Monoxide
(12)	**COR**	Certificate of Recognition
(13)	**CPR**	Canadian Pacific Railroad
(14)	**CSA**	Canadian Standards Association

(15)	**dBA**	Decibel with A-rating
(16)	**DBFMO**	Design Build Finance Maintain Operate
(17)	**DBFO**	Design Build Finance Operate
(18)	**DBO**	Design Build Operate
(19)	**DC**	Direct Current
(20)	**DCS**	Distributed Control System
(21)	**EPDM**	Ethylene Propylene Diene Monomer
(22)	**H_2S**	Hydrogen Sulphide
(23)	**HAZOP**	Hazard and Operability Study
(24)	**HD**	High Definition
(25)	**HDPE**	High Density Polyethylene
(26)	**HIRA**	Hazard Identification and Risk Assessment
(27)	**HMI**	Human Machine Interface
(28)	**HOA**	Hand-Off-Auto
(29)	**HVAC**	Heating, Ventilation and Air Conditioning
(30)	**IEC**	International Electrotechnical Commission
(31)	**IEEE**	Institute of Electrical and Electronics Engineers
(32)	**IESNA**	Illuminating Engineering Society of North America
(33)	**IFC**	Issued for Construction;
(34)	**IT**	Information Technology;
(35)	**I/O**	Input/Output
(36)	**JPEG**	Joint Photographic Experts Group
(37)	**LED**	Light Emitting Diode
(38)	**LEL**	Low Explosive Limit
(39)	**Leq**	Time Weighted Equivalent Sound Level
(40)	**LIMS**	Laboratory Information Management System

(41)	**LOTO**	Lock Out – Tag Out Procedure
(42)	**MCC**	Motor Control Centre
(43)	**SDS**	Safety Data Sheets
(44)	**NBCC**	National Building Code of Canada
(45)	**NC**	Noise Criteria
(46)	**NEMA**	National Electrical Manufacturer Association
(47)	**NEWPCC**	North End Sewage Treatment Plant (aka North End Water Pollution Control Centre)
(48)	**NFPA**	National Fire Protection Agency
(49)	**NIC**	Noise Isolation Class
(50)	**NOx**	Nitrogen oxides
(51)	**NPSH**	Net Positive Suction Head
(52)	**NPSHR**	NPSH Required
(53)	**NRC**	Noise Reduction Coefficient
(54)	**OWAM**	Oracle Work and Asset Management
(55)	**O&M**	Operation and Maintenance
(56)	**P3**	Public – Private – Partnership (P3) projects
(57)	**P&ID**	Process and Instrumentation Diagram
(58)	**PCS**	Process Control System
(59)	**PDA**	Pile Driving Analyzer
(60)	**PDF**	Portable Document Format
(61)	**PFD**	Process Flow Diagram
(62)	**PLC**	Programmable Logic Controller
(63)	**PMCS**	Power Management Control System
(64)	**PPE**	Personal Protective Equipment
(65)	**PVC**	Polyvinyl Chloride

(66)	**QMS**	Quality Management System
(67)	**RFP**	Request for Proposal
(68)	**SAE**	Society of Automotive Engineers
(69)	**SEI**	Structural Engineering Institute
(70)	**SEWPCC**	South End Sewage Treatment Plant (aka South End Water Pollution Control Centre)
(71)	**SIP**	Subsurface Investigation Plan
(72)	**SMACNA**	Sheet Metal and Air Conditioning Contractors National Association
(73)	**SOP**	Standard Operating Procedures
(74)	**STC**	Sound Transmission Class (laboratory)
(75)	**SWP**	Safe Work Procedure
(76)	**TAC**	Transportation Association of Canada
(77)	**TDH**	Total Dynamic Head
(78)	**TS**	Total Solids
(79)	**UHD**	Ultra High Definition
(80)	**UPS**	Uninterruptable Power Supply
(81)	**USS**	United States Standard
(82)	**UV**	Ultraviolet
(83)	**VDC**	Volts (DC)
(84)	**VFD**	Variable Frequency Drive
(85)	**VOIP**	Voice Over Internet Protocol
(86)	**VS**	Volatile Solids
(87)	**WBS**	Work Breakdown Structure
(88)	**WEWPCC**	West End Sewage Treatment Plant (aka West End Water Pollution Control Centre)
(89)	**WSHA**	The Workplace Safety and Health Act

(90) **WWD** Water and Waste Department

A.2 Design Builder's Responsibilities

A.2.1 Scope of Work for the Infrastructure

A.2.1.1 Design Builder shall perform the Works to deliver the Infrastructure that shall include the following:

(a) re-routing of interceptors, an interceptor junction chamber, and yard piping;

(b) a new headworks facility including raw sewage pumping, screening, and grit removal;

(c) a new odour control facility;

(d) a new standby power generation facility;

(e) new civil, mechanical, electrical and control infrastructure; and

(f) decommissioning of various existing infrastructure.

A.2.2 Design Build

A.2.2.1 Further to Section B4 of the DBA, Design Builder shall have complete responsibility to perform all of the Works to deliver the Infrastructure so as to provide an upgraded wastewater treatment Infrastructure that:

(a) is complete and operational and fit for its intended uses, as established by the requirements set out in this DBA;

(b) complies with the Treatment Standards;

(c) is capable of operating 24 hours per day under process control system (PCS) control based on Standard Staffing Levels and has received all necessary written authorizations or other approvals from Governmental Authorities to do so, except for any authorizations or other approvals for which the City is responsible for as listed below:

(i) Environment Act Licence No. 2684 RRR.

A.2.2.2 Design Builder is solely responsible for coordinating its activities including design, construction, testing and commissioning, decommissioning, Operations Advisory Services, and project closeout to avoid interference with City Operations. Design Builder shall not carry out any work on the Project that will disrupt City Operations unless such work has been previously coordinated through Appendix 18P – Coordination Protocol.

A.2.2.3 Design Builder is solely responsible for the quality of all services performed under the DBA. Design Builder shall be solely responsible for developing and implementing a Quality Management System in accordance with Section B.6.2, including quality assurance and quality control, and shall not depend in any way on the observations of the City to substitute for its own obligations. Design Builder shall implement and follow its Quality Management System, in compliance with the DBA, throughout all stages of performing the Works.

A.2.2.4 Design Builder shall minimize the number of conveyance and treatment interruptions of the Existing Infrastructure and shall only be permitted to interrupt conveyance or treatment when Design Builder has met the shutdown requirements in Section D.8 of this Schedule 18.

A.2.3 City Access to Project

A.2.3.1 Further to Section D1.4 and D8.3 of the DBA Design Builder shall:

(a) give City Party and the Independent Certifier access to drawings, specifications, schedules, records, quality control tests and reports, data sheets, log sheets, design calculations, laboratory reports, test sheets and other documents or data relating to the design and construction including such information that is being produced by or in the possession of Design Builder or others, as reasonably requested by the City or the Independent Certifier;

(b) permit City Party to attend Design Builder's internal design and construction meetings;

(c) permit City Party to attend equipment and vendor training sessions provided by Design Builder. City Party's participation in these activities shall not relieve the Design Builder of his duty to provide training in accordance with Appendix 18G – Training Requirements; and

(d) cooperate with the City to arrange for tours of the Lands at reasonable times during the Project Term for officials and other personnel, in a way that does not interfere with the progress of the Project and ensures personal safety.

A.2.3.2 During any such observation or inspection, all representatives and delegates of the City and the Independent Certifier will comply with all reasonable safety and other rules and regulations applicable to their presence in or upon the Lands and will in no material way interfere with the performance of design and construction. The right of access provided for under this Section will extend to all storage and testing facilities associated with the construction, whether located on or off the Lands.

A.2.4 Transfer of Documents to the City

A.2.4.1 All Project documentation to be submitted to the City as set out in this Schedule 18 shall be submitted in accordance with Schedule 13 – Document Management System and Section E4 of the DBA.

A.2.4.2 Design Builder shall submit the deliverables outlined in Appendix 18T – Document List. This summary has been provided for clarity and convenience of the Parties and may not fully represent all deliverables Design Builder is required to submit in accordance with this Schedule 18. For clarity, as set out in Section A.1.2 of this Schedule 18, the sections of the Technical Requirements will govern over Appendix 18T – Document List.

A.2.4.3 When submitting any Submittal to the City for review, in accordance with the procedures set out in Schedule 5 – Review Procedure, Design Builder shall provide all documents, reports, plans, drawings, specifications, design calculations, data, certificates, samples, shop drawings, mock-ups, logs, tests, methods, schedules, catalogue cuts and manufacturer's installation and other instructions, guides and manuals as required by this DBA and as required by the City to fully demonstrate that the design and construction complies with the requirements of this DBA.

A.3 Applicable Law and City Standards

A.3.1 Failure to Comply with Applicable Law

A.3.1.1 In the event that Design Builder or any Design Builder Party fails at any time to comply with Applicable Law with respect to the Project, Design Builder shall, without limiting any other obligation under this DBA and at no cost to the City:

(a) respond to any notice of non-compliance, warning letter, notice of violation or other enforcement action and address resolution of the issues;

(b) immediately correct such failure and resume compliance with Applicable Law;

(c) pay any resulting fines, assessments, levies, impositions, penalties or other charges;

(d) make all changes in performing the Project that are necessary to assure that the failure of compliance with Applicable Law will not recur; and

(e) comply with any corrective action plan filed with or mandated by any Governmental Authority to remedy a failure of compliance with Applicable Law.

A.3.2 Notice of Potential Changes in Law

A.3.2.1 Design Builder shall keep the City regularly advised as to potential changes in Applicable Law affecting the Project of which Design Builder has knowledge and provide recommended responses to such potential changes so as to mitigate any possible adverse economic impact on the City should a Change in Law actually occur.

A.3.3 City Standards

A.3.3.1 Design Builder shall meet the requirements set out in City Standards, that are listed in Appendix 18D – City Standards of this schedule, and as set out elsewhere in this DBA. The entire City Standard shall apply, unless expressly modified or noted otherwise in this DBA.

A.3.3.2 Design Builder shall take all responsibility for integrating all City Standards into its design and construction.

A.3.4 Permits, Licences and Approvals

A.3.4.1 The Design Builder shall submit a Permitting Management Plan as set out in Section C.2.3.

A.3.4.2 Applications and Submittals

A.3.4.2.1 Design Builder shall prepare all filings, applications and reports and take

all other action necessary to obtain and maintain all Permits, Licences and Approvals necessary to commence, continue and complete the Works. Where required under Applicable Law or requested by Design Builder, Permits, Licences and Approvals will be obtained in the name of the City, and in connection therewith, Design Builder shall:

(a) prepare the application and develop and furnish all necessary supporting material in support of the application;

(b) supply all data and information that may be required;

(c) familiarize itself with the terms and conditions thereof;

(d) attend and participate as necessary, all required meetings and hearings as necessary; and

(e) take all other action necessary in obtaining, maintaining, renewing, extending and complying with the terms thereof.

A.3.4.3 All permit filing fees, and associated costs required to obtain and maintain Permits, Licences and Approvals shall be paid by Design Builder, regardless of the identity of the applicant or permittee.

A.3.4.4 Communications Related to Permits, Licences and Approvals

A.3.4.4.1 Design Builder shall:

(a) when requested, notify the City in writing, 5 Business Days before any application, data submittal, or other communication with any Governmental Authority regarding Permits, Licences and Approvals;

(b) keep the City Representative fully informed of the details of all discussions and negotiations with Governmental Authorities with respect to all Permits, Licences and Approvals;

(c) provide the City Representative with copies of all documentation and correspondence with a Governmental Authority relating to such Permits, Licences and Approvals; and

(d) provide reasonable advance notice to the City of any meetings with municipal or other Governmental Authorities.

A.3.4.4.2 The City Representative or any person designated by the City Representative may attend meetings between Design Builder and any Governmental Authority upon request.

A.3.4.4.3 Design Builder shall notify the City Representative of any Building Permit Fee required to obtain a building permit, prior to payment of the Building Permit Fee. Design Builder shall provide, with the notice, all supporting documentation used to determine the value of the Building Permit Fee.

The City Representative will review the assessment of the Building Permit Fee and provide comments on the assessment or provide approval of the assessment. Design Builder shall only issue payment for the Building Permit Fee upon approval by the City Representative.

A.3.5 City Rights

A.3.5.1 Design Builder shall not knowingly take any action in any application, data submittal or other communication with any Governmental Authority regarding Permits, Licences and Approvals or the terms and conditions thereof that would impose any cost or unreasonable burden on the City or that would materially contravene any City policies with respect to the matters contained therein.

A.3.5.2 The City reserves the right to modify, alter, amend, delete or supplement any information supplied, or term or condition proposed, by Design Builder, that would impose any cost or unreasonable burden on the City.

A.3.5.3 The final terms and conditions of any Permit relating to the Operational Advisory Period and following will be subject to the City's approval, acting reasonably.

A.3.5.4 Design Builder shall deliver to the City, promptly after Design Builder's receipt, a copy of each permit, and will provide a listing of the status of all Permits, Licences and Approvals in its Monthly Project Report.

A.3.6 Reports to Governmental Authorities

A.3.6.1 With the exception of *Environment Act Licence No. 2648 RRR*, Design Builder shall:

(a) prepare all reports, make all information submittals and provide all notices to all Governmental Authorities required by all Permits, Licences and Approvals and under Applicable Law with respect to the Project;

(b) provide the City with copies of such regulatory reports for review, comment and signature, as applicable, at least 10 Business Days before their filing with the Governmental Authority, or concurrently with the filing in the event that Applicable Law require an immediate filing with the Governmental Authority; and

(c) certify to the City the accuracy and completeness of all reports, submittals, data and other information prepared by Design Builder and proposed for filing.

A.3.7 Design Builder Assumption of Permitting Risk

A.3.7.1 Design Builder explicitly assumes the risk of obtaining and maintaining all Permits, Licences and Approvals that are required to be obtained by Design Builder for the Project, including the risk of delay, non-issuance or the imposition of any term or condition in connection therewith by a Governmental Authority.

A.3.7.2 In assuming this risk, Design Builder acknowledges that the delay or non-issuance of any Permit required for the commencement or continuance of construction or performance of Performance Testing may have the effect of compressing the period within which the Project must be completed under this DBA in order to avoid delay costs pursuant to Section F of the DBA or termination pursuant to Section O of the DBA.

A.3.7.3 Design Builder further acknowledges that the Governmental Authority, in issuing any Permit, may impose terms and conditions that require Design Builder to make changes or additions to the design or construction that may increase the cost, time or risk to Design Builder of performing the design or construction, all of which costs, delays or risks will be for the account of and borne by Design Builder.

A.4 Non-Conformances

A.4.1 General

A.4.1.1 For all Work, a Non-Conformance shall be considered to have occurred when:

(a) Design Builder fails to perform any of its obligations under the Design Build Agreement with respect to any aspect of the Works;

(b) Design Builder fails to conform to the plans and procedures set out in Design Builder's Management Systems and Plans;

(c) deviating in a material manner from a previous Design Submittal (e.g. 60% Design to 90% Design). For clarity, any deviations permitted by the City in accordance with a RFS, as set out in Section A.4 of this Schedule 18, will not be considered a Non-Conformance;

(d) a deficiency or deficiencies in the characteristics, documentation or procedures that makes the quality of a product, activity or service unacceptable or not according to specified requirements, including Design Submittals, inspection and testing requirements and any other established acceptance criteria;

(e) Work was performed without documentation to conclusively demonstrate conformance to the Technical Requirements and the Final Design and which cannot be verified by non-destructive testing; and

(f) audits, assessments or investigations identify a discrepancy between the state of the Work and its representation by Design Builder or on Design Builder's documentation or correspondence.

A.4.1.2 Design Builder shall be solely responsible for all costs associated with the correction and rectification of all Non-Conformances.

A.4.2 Identification, Notification and Reporting

A.4.2.1 Design Builder shall maintain an up-to-date register of all Non-Conformances indicating their current status. The register shall be digitally prepared and updated on a real-time basis on Design Builder's DMS or made available within 1 Business Day upon request by the City. Access to the register shall be made available to the City throughout the Project Term.

A.4.2.2 Design Builder shall identify and notify the City in accordance with Schedule 13 – Document Management System, of each Non-Conformance, through the provision of a Non-Conformance Report, as set out in Section A.4.2.3 of this Schedule 18, within 2 Business Days of the occurrence of that Non-Conformance.

A.4.2.3 Design Builder shall create an NCR template that it will use to prepare an NCR for each Non-Conformance. Such template shall be used throughout the Project Term. Design Builder shall include sufficient information in the NCR, so the Parties have a full understanding of the Non-Conformance. At a minimum, each NCR shall include:

(a) title;

(b) date identified;

(c) identified by;

(d) tracking number;

(e) type (e.g. project management, design, construction, etc.);

(f) description;

(g) current status; and

(h) currently actioned to.

A.4.2.4 Design Builder shall submit to the City a NCR Plan, as set out in Section A.4.2.5 of this Schedule 18, for review in accordance with Schedule 5 – Review Procedure within 10 Business Days (or such longer time as the Parties may agree upon in writing) of when the Non-Conformance was identified.

A.4.2.5 Design Builder shall create an NCR Plan for each NCR. Design Builder shall include sufficient information in the NCR Plan, so the Parties have a full understanding of how Design Builder proposes to correct and rectify the Non-Conformance. Each NCR Plan shall include:

(a) all information included in the NCR, as set out in Section A.4.2.3 of this Schedule 18;

(b) proposed solution;

- schedule for implementing the proposed solution;

(d) root cause and corrective action;

(e) testing or verification steps, as applicable, that will be taken to prove the proposed solution was effective;

(f) drawing, plan or report reference;

(g) approval by Professional of Record or qualified person, as applicable;

(h) Quality Manager, Independent Quality Certifier and Design Manager approvals.

A.4.2.6 Further to Section A.4.2.5(d) of this Schedule 18, the assessment of the root cause and corrective action is not synonymous with the proposed solution, rather it is intended to assess the underlying conditions that ultimately caused or contributed to the Non-Conformance. The corrective action shall be prepared to address the root cause and not the output conditions associated with the Non-Conformance.

A.4.2.7 The NCR Plan shall be reviewed and approved by the Quality Manager, Independent Quality Certifier and Design Manager prior to the issuance to the City for review. Upon request, Design Builder shall provide a method to authenticate this review and approval documentation.

A.4.2.8 Payment Adjustment

A.4.2.8.1 Failure by Design Builder to submit an NCR Plan to the City within 10 Business Days that includes all information required under Section A.4.2.5 shall result in a Payment Adjustment in accordance with Schedule 14 – Payment Adjustment.

A.4.3 City Identified Non-Conformance(s)

A.4.3.1 If the City identifies a Non-Conformance, the City will notify Design Builder of that Non-Conformance, and a description of how the Work is non-conforming. Design Builder shall incorporate the Non-Conformance in their register as set out in Section A.4.2.1 of this Schedule 18.

A.4.3.2 Should Design Builder disagree with any Non-Conformance identified by the City, Design Builder shall remain obligated to include the Non-Conformance in their register and prepare an NCR Plan as set out in Section A.4.2.1 and A.4.2.5 of this Schedule 18, respectively. During the development of the NCR Plan, Design Builder shall provide for City review Design Builder's basis and justification of how the Work is in conformance with the Design Build Agreement or how the incidence of the Non-Conformance was previously identified by Design Builder and has been or is in the process of being corrected or rectified.

A.4.3.3 Should Design Builder disagree with any Non-Conformances identified by the City pursuant to Section A.4.3 of this Schedule 18, or the City disagrees with the

justification provided by Design Builder in accordance with Section A.4.3.2 of this Schedule 18, the Parties shall resolve the disagreement in accordance with the process set out in Schedule 7 – Dispute Resolution and Procedure.

A.4.4 Rectification of Non-Conformances

A.4.4.1 Regardless of which Party identifies a Non-Conformance, Design Builder shall be responsible to implement the proposed solution (i.e. rectifying the output conditions) and corrective actions (i.e. addressing the root cause), which shall be verified by the Quality Manager and Independent Quality Certifier, within the timeframe indicated in its NCR Plan.

A.4.4.2 Payment Adjustment

A.4.4.2.1 Failure to implement the proposed solution and corrective actions, including verification by the Quality Manager, within the schedule set out in the NCR Plan, which was endorsed “Received” in accordance with Schedule 5 – Review Procedure, shall result in a Payment Adjustment in accordance with Schedule 14 – Payment Adjustments.

A.4.4.3 Design Builder shall be responsible for updating the NCR register to indicate when the proposed solution and corrective actions were incorporated into the works and when the Quality Manager and Independent Quality Certifier verified the implementation of the solution and corrective actions.

A.4.4.4 Repeated Non-Conformances, including the same type of failure, root cause or proposed solution, shall cause Design Builder to update its QMS and QMP to prevent additional same Non-Conformances.

A.4.5 Auditing

A.4.5.1 The City will be entitled to audit the review and approval, supporting documentation and the Work performed to correct and rectify the Non-Conformance and may, if appropriate, identify an additional Non-Conformance in respect of any or all of the foregoing.

A.5 Requests to the City

A.5.1 Request for Information

A.5.1.1 If Design Builder requires additional information or clarification regarding the Project or Design Build Agreement, Design Builder may submit a RFI for City review in accordance with this Section A.5.1.

A.5.1.2 Only 1 topic shall be addressed per RFI submission.

A.5.1.3 Design Builder shall submit RFIs in accordance with Schedule 13 – Document Management System and reasonable instructions provided by the City.

A.5.1.4 Design Builder shall prepare a RFI template and shall use such template throughout the Project Term. The RFI template shall include:

(a) title of RFI;

(b) date prepared;

(c) prepared by;

(d) document number as issued by the City DMS;

(e) revision number to the RFI;

(f) description or details of the request; and

(g) space for City response.

A.5.1.5 City Response to Request for Information

A.5.1.5.1 The City will, as soon as is practicable and within 10 Business Days of receipt of a RFI (or such longer time as may be prescribed in the DBA or as the City reasonably requires), return a response on the relevant RFI, as is appropriate.

A.5.1.5.2 If the City has referred a RFI or a portion of a RFI to another entity or person, and as a result, the City is delayed in returning a response on the relevant RFI in the time-frame set out in Section A.5.1.5.1 of this Schedule 18, the City will, as soon as reasonably possible, notify Design Builder Representative of such delay.

A.5.1.5.3 For clarity, any response by the City delivered pursuant to a RFI shall not modify the terms of the Design Build Agreement.

A.5.1.6 Further Information Requested by the City

A.5.1.6.1 If the City so requires, Design Builder shall submit any further or other information, data and documents that may be reasonably required for a full appreciation of any RFI contemplated and its implications.

A.5.1.7 Request For Information Closure

A.5.1.7.1 The RFI is closed when the City has responded and closed the RFI to the satisfaction of the City acting reasonably. The City will notify Design Builder of the RFI closure in accordance with Schedule 13 – Document Management System.

A.5.2 Request for Substitution

A.5.2.1 The Contract Price is based upon the materials, equipment, methods, processes and plans identified and named in the DBA. Substitution or variance to those specified will not be permitted without submission, review and consideration by the City in accordance with this Schedule 18.

A.5.2.2 Design Builder may send a RFS requesting a substitution or variance from the DBA with respect to material, equipment, processes or plans of equal or better performance and quality in substitution for those specified if it meets the Technical Requirements.

A.5.2.3 Design Builder may proceed with the substitution or variance only if the City returns a response to the RFS permitting the substitution or variance and formalizes the change to the DBA in accordance with Schedule 17 – Change Orders. For clarity, permission from the City is required prior to proceeding with any substitution outlined in the RFS.

A.5.2.4 Design Builder shall prepare a RFS template and shall use such template throughout the Project Term. The RFS template shall include:

(a) title of RFS;

(b) date prepared;

(c) prepared by;

(d) document number as issued by the City DMS;

(e) revision number to the RFS;

(f) description or details of the request; and

(g) space for City response.

A.5.2.5 Request for Substitution Submission

A.5.2.5.1 If Design Builder desires to request a substitution, it shall submit a RFS in accordance with Schedule 13 – Document Management System. Such RFS shall include the information required in this Section A.5.2.5 and shall be issued on the RFS template prepared by Design Builder.

A.5.2.5.2 Design Builder shall provide sufficient information and details to enable the City to determine the acceptability of the alternate materials, equipment, processes, methods, and plans as an approved equivalent. The substitute shall meet all requirements of the DBA. In addition, Design Builder shall:

(a) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute.

(b) identify any anticipated cost or time savings that may be associated with the substitute including:

(i) an assessment of costs of Work solutions against aspects of performance to mitigate any conflicts with the purpose and need of the Project, including:

(A) safety;

(B) user needs;

(C) durability;

(D) long term performance;

(E) life-cycle costs; and

(F) any other purpose or need as reasonably requested by the City.

(c) identify capital cost savings that could be realized by the City through acceptance of the RFS. All capital cost savings realized by Design Builder shall be shared equally with the City. Cost savings shall be demonstrated through vendor quotations, Estimates, or any other documentation, as reasonably requested by the City, and must be expressly agreed upon and finalized via a Change Order in accordance with Schedule 17 – Change Orders;

(d) certify that the substitute will fully perform the functions called for by the Technical Requirements, be of equal or superior substance to that specified, is suited to the same use and environment, and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with this DBA;

(e) certify that the substitute will adequately perform the functions called for by the Design Builder's Design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the DBA; and

(f) certify that acceptance of the proposed substitute will not prejudice achievement of Substantial Completion;

A.5.2.6 Substitution of Manufacturer

A.5.2.6.1 Throughout Appendix 18B – Specifications, the City has specified manufacturers that provide products that meet the performance specifications and provide excellent long-term performance. The City will be responsible for long-term operations and maintenance upon completion of this DBA and is cautious regarding accepting substitute products. Notwithstanding, in every instance where a brand name is used, the City will consider substitutes in accordance with this Section A.5.2.

A.5.2.6.2 If Design Builder desires to use an alternate manufacturer, Design Builder

shall submit a RFS, in accordance with Section A.5.2.5 and provide a minimum of 1 reference to an installation where the substitute was used to perform similar functions as specified in the Technical Requirements in a similar environment and has been in operation for a minimum of 5 years. The reference shall include:

(a) a contact name with telephone number and email address;

(i) contact person shall be able to communicate via spoken and written English.

(b) manufacturer and model of the product installed at the reference installation;

(i) model shall be similar to the product for which Design Builder is requesting as an approved equivalent.

(c) date of installation;

(d) description of the function performed by the product;

(e) description of the operating environment in which the product was installed; and

(f) maintenance records for the product from the date of installation, including:

(i) warranty claims;

(ii) requests for the supplier's technical support;

(iii) dates and duration that the product was off site receiving service; and

(iv) dates and duration that supplier's technical support was physically on site servicing the product.

A.5.2.6.3 Provide information on the supplier of the product including:

(a) registered business name and address;

(b) contact name with telephone number and email address;

(c) number of years supplying the product; and

(d) supplier's technical support staff who will respond to service questions and requests, including:

(i) name, telephone number, and email address;

(A) such person shall be able to communicate via spoken and written English.

(ii) guarantee that the such person can physically report to the NEWPCC Facility within 24 hours of receiving a service request;

(iii) number of years that such person has been providing technical support for the product for which Design Builder is requesting an approved equivalent; and

(iv) documentation demonstrating that such person has the technical knowledge to operate, maintain and optimize the product in accordance with its intended function.

A.5.2.7 The City may contact the reference contact person to verify the information required in Section A.5.2.5. Design Builder is solely responsible for the availability of the reference contact person. Failure by the reference contact person to respond to the City will result in the submission being rejected and such rejection will count against the maximum allowable number of submissions.

A.5.2.8 Design Builder will only be permitted to submit a RFS, or a revision to such RFS up to a maximum of 2 times. A submission that does not include all the information required under Section A.5.2.5 will be rejected and will count against the maximum allowable number of submissions.

A.5.2.8.1 For clarity, any response by the City delivered pursuant to a RFS shall not modify the terms of the Design Build Agreement, with the exception of those RFS where the City has indicated they will permit the substitution or variance and has subsequently been formalized in a Change Order as set out in Schedule 17 – Change Orders.

A.5.2.9 Request for Substitution Response by the City

A.5.2.9.1 The City will, as soon as is practicable and within 10 Business Days of receipt of a RFS (or such longer time as may be prescribed in the DBA or reasonably required by the City), return a response on the relevant RFS, as is appropriate.

A.5.2.9.2 If the City has referred a RFS or a portion of a RFS to another entity or person and, as a result, the City is delayed in returning a response on the relevant RFS the City will, as soon as reasonably possible, notify Design Builder Representative of such delay.

A.5.2.9.3 The City may authorize or reject the substitution as outlined in the RFS solely at the City's discretion. For clarity, no response by the City on a RFS and no failure by the City to provide comment, response or participate in any manner in respect of the RFS shall:

(a) grant Design Builder authorization to proceed with the substitution;

(b) relieve Design Builder from Design Builder's exclusive responsibility to ensure that the Project complies with the DBA;

(c) excuse any failure by Design Builder to carry out the Work in accordance with the DBA; or

(d) estop the City from asserting any non-compliance with the DBA.

A.5.2.9.4 It is Design Builder's sole responsibility to provide the information required under Section A.5.2.6 in a legible, organized manner. Failure to do so may result in the submission being rejected and such rejection will count against the maximum allowable number of submissions.

A.5.2.10 Further Information Requested by the City

A.5.2.10.1 If the City so requests, Design Builder shall submit any further or other information, data and documents that may be reasonably required for a full appreciation of any RFS contemplated and its implications. Design Builder shall take all such steps as may be reasonably required to satisfy the City that the proposed substitution or proposed course of action is of equal or better performance and quality and complies with the DBA and Technical Requirements.

A.5.2.11 Request for Substitution Closure

A.5.2.11.1 A RFS is closed when the City has responded to the satisfaction of the City acting reasonably. The City will notify Design Builder of the RFS closure in accordance with Schedule 13 – Document Management System.

A.5.2.11.2 The City will formalize any permitted substitution or variation by the City to the DBA and the Technical Requirements in accordance with Schedule 17 – Change Orders once the RFS is closed.

SECTION B. MANAGEMENT OF THE PROJECT

B.1 General

B.1.1 General Responsibilities

B.1.1.1 Design Builder acknowledges and agrees that a comprehensive integrated management methodology is critical to meet Design Builder's Project Schedule and Project objectives set out in Section A.2.2.

B.1.1.2 Design Builder shall develop and implement an integrated management methodology to perform the Work, documented in a Project Management Plan, that meets the requirements set out in B.2.1.

B.1.1.3 Design Builder shall ensure that all aspects of the Work are subject to the integrated management methodology and shall comply with and cause all Design Builder Parties to comply with the requirements of the Project Management Plan.

B.1.1.4 Design Builder's Management Systems and Plans shall utilize defined expressions, terminology and cross-references, consistent with and in accordance with the Design Build Agreement (excluding Schedule 2 – Design Builder's Project Schedule, Schedule 3 – Design Builder's Proposal Extracts and Schedule 4 – Design Builder's Management Systems and Plans).

B.1.1.5 Design Builder's Management System and Plans shall include cross-references (including section numbers) to individual management plans to aid the reader in understanding and locating relevant content.

B.1.1.6 The following management plans described in this Section B shall form part of Schedule 4 – Design Builder's Management Systems and Plans:

(a) Project Management Plan as described in Section B.2.1, which includes the:

(i) Scope Management Plan as described in Section B.3.1;

(ii) Schedule Management Plan as described in Section B.4.1;

(iii) Cost Management Plan as described in Section B.5.1, which includes the:

(A) Lifecycle Cost Management Plan as described in Section B.5.2; and

(iv) Design Quality Management Plan as described in Section B.6.1.3;

(v) Construction Quality Management Plan as described in Section B.6.1.4;

(vi) Commissioning Quality Management Plan as described in Section B.6.1.5;

(vii) Resource Management Plan as described in Section B.7.1;

(viii) Communications Management Plan as described in Section B.8.1, which includes the:

(A) Document Management Plan as described in Section B.8.2; and

(ix) Risk Management Plan as described in Section B.9.1; and

(x) Procurement Management Plan as described in Section B.10.1.

B.1.1.7 The management plans, including any updated and revised plans, shall be reviewed in accordance with Schedule 5 – Review Procedure. Updated and revised management plans shall supersede previous versions.

B.1.1.8 Design Builder's Management Systems and Plans submitted with the Design Builder's Proposal, shall be considered the baseline for the development of Design Builder's Management Systems and Plans.

B.1.1.9 Design Builder shall implement Design Builder's Management Systems and Plans throughout the Project Term.

B.1.1.10 Design Builder shall collect, measure and assess measurements and trends to effect integrated management process improvements. Integrated management process improvements shall be incorporated into Design Builder's Management Systems and Plans as required, but not less frequently than annually, and submitted in accordance with Schedule 5 – Review Procedure prior to changing or modifying Design Builder's integrated management methodology.

B.1.1.11 Design Builder Party Non-Conformances to Design Builder's Management Systems and Plans shall be reported and addressed as set out in Section A.4.

B.1.1.12 Design Builder shall implement all Management Systems and Plans and monitor their performance to maintain effectiveness over the course of performing the Project. Design Builder shall not amend or update any Design Builder's Management System and Plans that have been endorsed as "Received" by the City until such amendment or update has also been marked "Received" by the City in accordance with Schedule 5 – Review Procedure.

B.2 Project Management

B.2.1 Project Management Plan

B.2.1.1 Design Builder shall develop a comprehensive Project Management Plan that meets the requirements of Section B.1 of this Schedule 18 and:

(a) describes the overarching integration management methodology including the process for measuring and improving the overall performance of implementation;

(b) describes how the Project will be executed, monitored and controlled and closed;

(c) integrates and consolidates all subsidiary management plans and baselines, and other information necessary to manage the Project;

(d) is robust enough to respond to an ever-changing Project environment;

(e) describes the process for assessing Change Order Enquiries and implementing Change Orders in an integrated manner (integrates scope, schedule, cost, quality, resource, communications, risk, procurement and stakeholder considerations);

(f) incorporates mechanisms to support partnership practices among the Parties throughout the Project Term;

(g) includes effective issue management processes that facilitate issue resolution among Design Builder Parties to preserve the Project objectives; and

(h) describes how Design Builder's Management Systems and Plans will be audited in accordance with Section B.6.5.1 and B.6.5.1.3 to affect continuous improvement.

B.2.1.2 The Project Management Plan shall include the processes and activities to identify, define, combine, unify and coordinate the various project management activities within the Project Management Plan.

B.2.1.3 The Project Management Plan shall include the following subsidiary management plans:

(a) Scope Management Plan;

(b) Schedule Management Plan;

(c) Cost Management Plan;

(d) Quality Management Plans;

(e) Resource Management Plan;

(f) Communications Management Plan;

(g) Risk Management Plan; and

(h) Procurement Management Plan.

B.2.1.4 Where applicable, the Design Builder may demonstrate compliance with the requirements of the subsidiary plans listed in Section B.2.1.3, by providing a reference to other management plans that form part of Design Builder's Management Systems and Plans including:

(a) Design management plans as described in C.2;

(b) Construction management plans as described in D.2; and

(c) Commissioning management plans as described in E.2.

B.3 Scope Management

B.3.1 Scope Management Plan

B.3.1.1 Design Builder shall develop a comprehensive Scope Management Plan, as part of the overall Project Management Plan, that describes how the Work will be monitored, controlled and validated, which includes:

(a) a scope statement, including a narrative describing:

(i) the scope of Work and its deliverables;

(ii) out-of-scope work or deliverables;

(iii) constraints;

(iv) assumptions; and

(v) methodology for achieving Milestone Criteria and Milestone Certificates.

(b) a Work Breakdown Structure. Design Builder shall establish a work break down structure or WBS that clearly identifies major and minor work activities required to complete the Works (the "**Work Breakdown Structure**"). The WBS shall include all activities required for the Works. The WBS shall identify Design Builder Party accountable for the completion of each WBS package;

(c) an overview of the processes utilized to measure and validate Design Builder Party completion of each WBS package;

(d) the process for incorporating Change Orders into the Scope Management Plan;

(e) health and safety management; and

(f) environmental management.

B.4 Schedule Management

B.4.1 Schedule Management Plan

B.4.1.1 Design Builder shall develop a comprehensive Schedule Management Plan, as part of the overall Project Management Plan, that establishes the criteria and the activities for developing, monitoring and controlling the schedule to meet Substantial Completion and Final Completion, and includes:

(a) the scheduling methodology and the scheduling tool to be used in the development of the project schedule model;

(b) a narrative, accompanied by a simplified time schedule of Design Builder's approach to completing the Work, including sequence of each Milestone completion;

(c) an overview of the processes utilized to measure progress, including how Design Builder Party individual WBS package progress will be integrated into master scheduling and reporting systems during Project execution;

(d) general approach to re-scheduling to achieve recovery of time lost on the Project Schedule;

(e) process for monitoring, remedying, mitigating or otherwise addressing the schedule consequences of risks identified in the risk register; and

(f) the process for incorporating Change Orders into the Project Schedule.

B.4.2 Project Schedule

B.4.2.1 The Project shall be undertaken by Design Builder in accordance with the Project Schedule for the following:

(a) planning, organizing and executing the Work to meet the Milestones, Scheduled Substantial Completion Date and Scheduled Final Completion Date as defined in the DBA;

(b) reporting planned, actual or forecast start and completion dates of all activities;

(c) reporting actual versus planned percent complete progress of all activities

(d) supporting evaluation of the potential impact of changes and time extensions, and the inclusion of impacts that are included in City approved changes and time extensions;

(e) developing any schedule remediation plans as may be required;

(f) enabling the City to monitor and evaluate work progress and forecast completion of individual activities, completion of Milestones, and completion of the overall Project; and

(g) ensuring activities are planned and controlled to complete activities in accordance with schedules and deadlines;

B.4.2.2 Such Project Schedule shall be based on the project schedule included in Schedule 2 – Design Builder's Project Schedule.

B.4.2.3 The Project Schedule shall be prepared in critical path method format and clearly indicate the anticipated critical path(s) for the Project. Float or slack time in the individual activities and the critical path is not for the exclusive use or benefit of either the City or Design Builder, but is a resource available to both Parties, as needed, to meet the Scheduled Substantial Completion Date and Scheduled Final Completion Date.

B.4.2.4 The Project Schedule shall reflect the WBS prepared for the Scope Management Plan.

B.4.2.5 Design Builder's Project Schedule shall outline the planning, design, permitting, procurement, construction, plant staff training, testing and commissioning activities Operations Advisory activities, Process Performance Guarantee activities, and project closeout in a sufficient level of detail of the WBS to enable the City to interpret the schedule and facilitate monitoring of the Works progress including:

(a) commencement date;

(b) Milestones dates;

(c) Scheduled Substantial Completion date;

(d) Scheduled Final Completion date;

(e) site studies and investigation activities;

(f) design activities including start and completion dates;

(g) Permits, Licences and Approvals dates;

(h) submission and review dates for Design Builder's Management Systems and Plans required for the Works;

(i) submission of Design Submittal packages for City review, in accordance with Schedule 5 – Review Procedure;

(j) HAZOP workshops;

(k) asset criticality workshop;

(l) computer and physical modeling activities;

(m) mobilization activities;

(n) procurement activities for major equipment and materials, including key dates for purchase and delivery of major equipment and material items;

(o) construction activities sequencing as well as start and completion dates;

(p) interfaces and tie-ins with existing plant facilities together with planned plant shutdowns;

(q) levels of overall craft labour each month (estimated individuals), for each craft and total craft;

(r) start and completion of training activities for plant staff, including submittals of training materials for City review and acceptance;

(s) Functional, Systems Operational, and Performance Testing including start and completion dates for each major system, process, and Infrastructure;

(t) completion of Operations and Maintenance Information, Phase 1 Asset Registry and Phase 2 Asset Registry, and As-Built Submittal; and

(u) all other activities for compliance with the DBA to achieve Substantial Completion, Final Completion, and Final Acceptance.

B.4.2.6 The Project Schedule shall be in the format of a Gantt chart for the Work based on a critical path method schedule that corresponds to the WBS. For each scheduled activity within the schedule, Design Builder shall identify the following:

(a) task name;

(b) task duration;

(c) task start date;

(d) task end date; and

(e) interdependency with other tasks (i.e. finish-to-start, start-to-finish, start-to-start, finish-to-start).

B.4.2.7 Design Builder shall submit with each Monthly Project Report, an updated Project Schedule indicating the progress of the items in Section B.4.2.5, with regard to planned, actual or forecast start and completion dates, as well as percent complete progress of each activity.

B.4.2.8 For clarity, Design Builder, when preparing Project Schedule updates, shall not modify the Scheduled Substantial Completion Date or Scheduled Final Completion Date, except as permitted by the City and formalized through Schedule 17 – Change Orders.

B.4.2.9 The monthly Project Schedule submittal shall consist of the following:

(a) a narrative indicating the current schedule status of the Project with regard to percent complete of the items listed in Section B.4.2.5;

(b) a narrative description of the critical path, including any changes from the previous month;

(c) a narrative description of any current schedule challenges or issues with potential to delay the schedule, and Design Builder's approach to address those issues;

(d) a Gantt chart of the overall Project status;

(e) any new significant deviations of any Milestone or major task, including:

(i) delivery requirements for major plant equipment;

(ii) major tie-ins to existing plant systems and facilities;

(iii) the delivery of Operation and Maintenance Information;

(iv) the first date of planned training for plant staff; and

(v) the date for initial start-up or commissioning of major process systems and facilities;

(f) a full critical path method network indicating the critical path(s) and any changes from the previous month;

(g) a 3-month detailed look-ahead schedule of all activities within the current month and the following 3 months, including:

(i) Submittals;

(ii) HAZOP reviews;

(iii) Design Progress Meetings, Pre-Submittal Presentations, or Design Submittal Review Workshops;

(iv) shop assembly, inspection and testing of major equipment and systems;

(v) planned tie-ins;

(vi) planned shutdowns;

(vii) design, procurement, construction, commissioning activities, and project closeout; and

(viii) any activities that will require coordination with plant staff.

(h) a 4-week detailed look-ahead schedule of daily activities for the current week and the following 4 weeks;

(i) updated Milestone Payment dates, if applicable; and

(j) incorporates any changes to the Project Schedule in accordance with Scheduled 17 – Change Orders, if applicable.

B.4.3 Schedule Remediation Plan

B.4.3.1 Further to Section E10 of the DBA, Design Builder agrees that whenever it becomes apparent that the actual progress of the Works has fallen behind schedule such as the planned Milestones, including the Scheduled Substantial Completion Date or Scheduled Final Completion Date, Design Builder shall develop a Design Builder Schedule Remediation Plan and submit in accordance with Schedule 5 – Review Procedure. The Design Builder Schedule Remediation Plan shall include:

(a) a description of the reasons for the schedule delay;

(b) a description of how Design Builder will recover from the delay;

(c) a revised Project Schedule

(d) a description of any changes to management practices; and

(e) a description of additional equipment, resources, working hours, trades, subcontractors, etc. that will be used by Design Builder to regain the schedule.

B.4.3.2 For clarity, the review of any Design Builder Schedule Remediation Plan by the City under Schedule 5 – Review Procedure shall not, under any circumstances whatsoever, constitute a change to the Project Schedule.

B.4.3.3 For the Project Schedule activities, Design Builder shall use either Oracle Primavera or Microsoft Project software. If Oracle Primavera is used, provide a total of 3 licences for the City and City Parties in addition to its own requirements.

B.4.4 Time Impact Analysis

B.4.4.1 When changes or delays are experienced because of a Change Order, Design Builder shall submit a written time impact analysis ("**Time Impact Analysis**") to the City illustrating the influence of each change or delay in the Project Schedule.

B.4.4.2 Each Time Impact Analysis shall include a fragment network analysis (fragnet), demonstrating the following:

(a) how Design Builder proposes to perform the changed Work including:

(i) a listing of activities required to execute the changed Work;

(ii) how Design Builder proposes to incorporate the change into the critical path method network;

(iii) additionally, the analysis shall demonstrate the time impact based on the following:

(A) the date that Design Builder was authorized to proceed with the change or anticipates the issuance of authorization;

(B) the status of design and construction at that point in time as reported in the alleged change; and

(C) the event time computation of all affected activities. The event items used in the analysis shall be those included in the latest updated copy of the Project Schedule or as adjusted by mutual agreement.

B.4.4.3 Time extensions will be granted only to the extent that equitable time adjustments for the activities affected exceed the total or remaining float along the critical path at the time of actual delay or at the time Design Builder was notified that the change was authorized.

B.4.4.4 Each Time Impact Analysis shall be submitted within 5 Business Days after a delay occurs or is recognized, or Design Builder receives a directive or request for proposal for a potential change from the City.

B.4.4.5 In cases where Design Builder does not submit a Time Impact Analysis for a specific change or delay within the specified period of time, it is mutually agreed that particular potential revision or delay has no time impact on the Scheduled Substantial Completion Date and Scheduled Final Completion Date and no time extension will be granted.

B.4.4.6 Acceptance or rejection of each Time Impact Analysis by the City shall be made within 10 Business Days after receipt of each Time Impact Analysis, unless subsequent meetings and negotiations are necessary. Upon acceptance, a copy of the Time Impact Analysis signed by the City Representative shall be returned to Design Builder.

B.4.4.7 Upon mutual agreement by both Parties, fragnets illustrating the influence of Change Orders and delays shall be incorporated into the first update of the Project Schedule.

B.5 Cost Management

B.5.1 Cost Management Plan

B.5.1.1 Design Builder shall develop a comprehensive Cost Management Plan, as part of the overall Project Management Plan, that establishes the criteria and the activities for developing, monitoring and controlling costs, and includes:

(a) methodology for evaluating costs of Work solutions against aspects of performance to mitigate any conflicts with the purpose and need of the Project, including:

(i) safety;

(ii) user needs;

(iii) durability;

(iv) long term performance;

(v) lifecycle costs in accordance with Section B.5.2 of this Schedule 18; and

(vi) and other parameter as requested by the City, acting reasonably.

(b) process for monitoring, remedying, mitigating or otherwise addressing the cost consequences of events that are, or may be, or are likely to become, a Relief Events; and

(c) approach to minimize any increase in costs and maximize any reduction in costs related to Change Orders.

B.5.2 Lifecycle Cost Management Plan

B.5.2.1 Design Builder shall develop and submit its plan for minimizing lifecycle cost to the City (the "**Lifecycle Cost Management Plan**").

B.5.2.2 This plan shall include as a minimum, the specific approaches to processes, innovations, features and procedures that Design Builder indicated as life cycle cost savings strategies in Schedule 4 – Design Builder's Management Systems and Plans. These may include, the following:

(a) minimizing the usage of electricity. Particular focus shall be given to those areas of the plant that use large amounts of electricity;

(b) minimizing the usage of natural gas for both process heating and space heating;

(c) minimizing the usage of City water; or

(d) minimizing the water content in the screenings and grit that must be hauled off site.

B.6 Quality Management

B.6.1 Quality Management Plans

B.6.1.1 Design Builder shall develop 3 comprehensive Quality Management Plans as described in Sections B.6.1.3, B.6.1.4, and B.6.1.5 of this Schedule 18. The Quality Management Plans shall identify quality requirements and/or standards for the Project and its deliverables, and documents how the Work will demonstrate compliance with quality requirements and/or standards.

B.6.1.2 In addition to the specific requirements set out in Sections B.6.1.3, B.6.1.4, and B.6.1.5 of this Schedule 18, and other requirements to meet Section B.6 of this Schedule 18, Design Builder shall include in its Quality Management Plans:

(a) how Design Builder will plan, develop and implement the QMS processes needed to complete the Project;

(b) a description that clearly differentiates the roles and responsibilities of the Quality Manager and Independent Quality Certifier for implementation and monitoring of the QMS;

(c) the process for integrating quality requirements and/or standards for the Project and its deliverables into individual Design Builder Parties' execution of the WBS packages;

(d) how the QMS will be fully integrated with the day-to-day Work of the Project;

(e) how Design Builder Party demonstrates compliance with the Technical Requirements and Schedule 4 – Design Builder's Management Systems

and Plans, including how Design Builder Party individual WBS package compliance is monitored and controlled;

(f) how the performance of the QMS is being monitored and at what frequency. This shall include auditing, control of non-conforming Work in accordance with Section A.4, and corrective and preventative actions;

(g) the documentation requirements for quality management and how these documents are controlled; and

(h) the process for incorporating Change Orders into the Quality Management Plan.

B.6.1.3 Design Quality Management Plan

B.6.1.3.1 Design Builder shall develop, implement and prepare a "**Design Quality Management Plan**" that requires:

(a) implementation of 3D CAD in accordance with Appendix 18C – Drafting Requirements;

(b) all applicable designs and professional documents, including plans, engineering drawings, detailed drawings, maps, specifications, reports and other documents, that describe engineering or geoscientific work as contemplated in the *Engineering and Geoscientific Professions Act* (Manitoba) to be authenticated by a Professional Engineer or Geoscientist, as applicable, in accordance with the *Engineering and Geoscientific Professions Act (2015), Engineers Geoscientists of Manitoba By-Laws (2016) and Engineers Geoscientists Manitoba Code of Ethics (2000).*;

(c) all designs and professional documents, including plans, architectural drawings, detailed drawings, maps, specifications, reports and other documents, that describe architectural work as contemplated by the *Architects Act* (Manitoba) to be stamped and signed by an architect licensed in Manitoba; and

(d) all design work to be reviewed, checked, and verified by an independent reviewer (the "**Independent Reviewer**"), who shall be a qualified professional, as required, and who may be employed by the same entity doing the design work; however, the Independent Reviewer shall not be the Professional of Record.

B.6.1.3.2 The Independent Reviewer shall:

(a) provide independent design check notes and report that the design checks have been completed based on the information provided by a qualified professional for the works and that the design complies with the requirements of the Technical Requirements;

(b) review and confirm that the entire scope of work has been performed and completed in accordance with the DBA and all subsequent amendments; and

(c) sign Design Builder's Design Submittal including design reports, design drawings and related documents.

B.6.1.3.3 All changes made to the design during construction are to follow the same review processes. Design Builder is to provide evidence to the City of such compliance.

B.6.1.3.4 Design Builder shall ensure that all City comments on design deliverables are tracked and resolved before issuance of Issued for Construction Documents.

B.6.1.4 Construction Quality Management Plan

B.6.1.4.1 Design Builder shall prepare a "**Construction Quality Management Plan**" that:

(a) sets out procedures to ensure the entire project scope of work is completed;

(b) details Design Builder's measures required to complete all aspects of the construction pursuant to its Quality Management System and in accordance with the requirements of this DBA, including this Section B.6.1.4 and the Technical Requirements;

(c) sets out a methodology to verify compliance of the construction, including all materials, equipment, products and workmanship, with the IFC Documents and Final Design including verification of buried or hidden infrastructure prior to cover up;

(d) sets out a methodology to track, audit and verify changes to the design during construction to ensure that all design changes are reviewed and accepted by designers and have been communicated with the City. Such register shall be available to the City via Design Builder's DMS and shall be provided by Design Builder within 1 day upon request by the City;

(e) sets out a methodology to ensure received equipment and materials matches approved shop drawings and is stored according to manufacturer's or supplier's recommendations;

(f) sets out methodology to ensure that installed infrastructure, survey information, and construction information is tracked, audited, verified and incorporated into the As-Built Construction Drawings and Record Drawings information package in accordance with Section G.2.2;

(g) provides an inspection and testing plan (the "**Inspection and Testing Plan**") that:

(i) defines types and frequency of quality control inspections and testing to be performed during the execution of the work, to verify compliance with the Technical Requirements and the Final Design;

(ii) defines types and frequency of quality assurance inspection and testing to be performed during the execution of the work to verify the performance of the quality control program; and

(iii) defines the role of the designers to perform inspections during construction to confirm design conformance;

(h) details the testing and acceptance program for all construction materials, products, equipment and systems, including the following:

(i) importance of construction quality, including material and equipment testing and inspections, testing and inspection frequencies, quality reference standards, product acceptance and rejection criteria;

(ii) procedures for corrective action when quality control or acceptance criteria are not met;

(iii) procedures for conducting inspections and, where required, obtaining relevant Permits, Licences and Approvals;

(iv) procedures for inspection during fabrication, factory acceptance testing, release to Design Builder, and site acceptance testing;

(v) if required by any applicable Governmental Authority, Applicable Law, standards, codes, and guidelines or Permits, Licences and Approvals, any boilers, pressure vessels and elevating devices must comply with and be inspected in accordance with the *Technical Safety Act* (Manitoba) and Design Builder shall have a Quality Management System program for such equipment registered and acceptable to the Inspector appointed under the Technical Safety Act;

(vi) procedures to ensure that all materials and substances that will come into contact with potable supplied water as part of the construction are approved for that purpose and are protected from any cross connection;

(vii) feedback to designers for improvement of construction material, equipment quality or workmanship;

(viii) measures to ensure that all Design Builder Parties are qualified and/or licensed as required;

(ix) roles and responsibilities of Design Builder's staff and the Independent Quality Certifier in the quality control and quality assurance processes; and

(x) identifies all Deficiencies and Non-Conformances, and tracks, audits and verifies closure of each.

B.6.1.5 Commissioning Quality Management Plan

B.6.1.5.1 Design Builder shall develop and implement a "**Commissioning Quality Management Plan**" that sets out the requirements for quality management during testing and commissioning, including requirements for the following:

(a) proper selection, installation, calibration and use of testing equipment, apparatuses, and assemblies with personnel trained in the trades and professions required to assure competent workmanship, including documentation and record of the skills and training of workers engaged in the installation of testing equipment;

(b) all commissioning work to be reviewed, checked and verified by an Independent Reviewer;

(c) documentation and record of the calibration of instruments and tools used in the testing phase;

(d) documentation and record of sampling and analysis quality assurance; and

(e) supervision of the installation of testing devices

B.6.2 Quality Management System

B.6.2.1 General

B.6.2.1.1 Design Builder shall have a Quality Management System to provide an organizational structure, procedures, processes and resources necessary to implement a comprehensive, planned and systematic program, pursuant to this Design Build Agreement, to ensure that the standards of quality management (quality control and quality assurance) required by this Design Build Agreement are achieved by Design Builder in every material aspect.

B.6.2.1.2 Design Builder shall implement and follow the QMS throughout all stages

of the Works.

B.6.2.1.3 While ISO certification is not mandatory, the QMS shall be consistent with the requirements of ISO 9001:2008 and all subsequent revisions and shall address all stages of the Works in accordance with the Design Build Agreement.

B.6.2.1.4 All records from the QMS, including all audits, shall be maintained and retained by Design Builder for the duration of the Project Term or until otherwise agreed to in writing by the City Representative.

B.6.2.1.5 Design Builder shall make all QMS records available to the City for inspection and review. Design Builder shall provide the City with a copy of any or all quality records when requested.

B.6.2.1.6 The QMS shall require all Design Builder Parties be contractually obligated to implement quality control programs that support the QMS and meet the Technical Requirements.

B.6.2.1.7 The QMS shall cover all activities, products and services required by this DBA before the performance or provision of those activities, products and services.

B.6.2.1.8 Design Builder shall design and implement a Quality Management System that:

(a) provides a framework for the integration and structuring of the various Quality Management Plans that comprise Design Builder's Quality Management System;

(b) integrates all Design Builder services to perform the Works, and includes detailed quality assurance and quality control procedures, training, staffing assignments, and communication protocols;

(c) includes procedures to monitor, update, and manage the Quality Management System and Quality Management Plans on an ongoing basis, as well as policies and procedures for resolving quality issues and for assessing the effectiveness of the Quality Management System;

(d) defines how Design Builder will ensure that City's quality objectives set out in this DBA are met, including provisions for involving representatives of City and its representatives in discussions related to quality and provisions for reporting quality assurance and quality control findings to the City;

(e) defines a quality assurance approach to ensure that quality control procedures and activities meet the objectives of the Quality Management System;

(f) provides a review by supervisory and lead personnel of the applicable Quality Management Plan to manage essential quality issues and objectives related to that activity, before the start of each major design, permitting, procurement, fabrication, construction, testing and commissioning activity;

(g) requires the provision of durable, dependable and high-quality assets that will meet the Technical Requirements of the Infrastructure and provide dependable service after Substantial Completion for its intended service life;

(h) integrates and coordinates offsite factory inspection, performance and acceptance testing and reporting requirements;

(i) integrates and coordinates designers, engineers, permitting personnel, equipment manufacturers and construction contractors into all phases of the Project to verify the quality of the work;

(j) ensures quality problems are discovered early, resolved quickly, corrected adequately and do not recur;

(k) provides for independent oversight equipped with adequate resources to ensure that quality is not compromised;

(l) requires quality control reports and quality assurance reports to include a certification by a qualified professional that work performed and reported in any such report is in accordance with the Quality Management System;

(m) requires Design Builder to review the quality plans, audits and work of each Design Builder subconsultants, subcontractors, and suppliers to ensure that the foregoing support Design Builder's and City's quality objectives and Quality Management System requirements;

(n) integrates permitting, design, equipment and material procurement, construction, testing, training, commissioning, asset management, operations advisory services, and related documentation including detailed quality assurance and quality control procedures, staffing assignments, communication protocols, training, and other aspects;

(o) defines the process of how City comments resulting from review of submittals will be tracked and resolved;

(p) defines how the design deliverables will be reviewed, verified and sealed and signed in accordance with the requirements of the *Engineering and Geoscience Professions Act* (Manitoba), *Architects Act* (Manitoba) and Governmental Authorities; and

(q) defines how the Professionals of Record will participate in periodic review during construction, testing and commissioning to ensure compliance with the Final Design.

(r) ensures persons participating in the Project are competent to do their required tasks and are qualified and licensed as applicable;

(s) clearly defines, identifies and communicates:

(i) the management, organizational structure, roles and responsibilities, and communication and coordination procedures for everyone participating in the Project (including those persons participating in the Project remotely from different locations); and

(ii) the persons responsible for carrying out quality control and quality assurance activities and their responsibilities relative to the Quality Management System.

(t) ensures data and information relating to the design and construction is collected, stored, and organized efficiently to support the management and reporting requirements of this DBA;

(u) ensures work is properly planned and implemented according to established procedures, the requirements of any applicable Governmental Authority, Applicable Law, standards, codes, guidelines, and Permits, Licences and Approvals;

(v) ensures that materials and equipment are designed, procured and installed to meet the quality requirements of the Technical Requirements;

(w) ensures that the quality control and assurance processes are audited by Design Builder for effectiveness;

(x) records deficiencies and non-conformances, and requires prompt and effective corrective action, complete with auditable documentation;

(y) ensure work processes are continually improved through measurement of performance against the quality objectives (including both City's and Design Builder's objectives), analysis of root causes is conducted in the event of non-conformance and feedback of lessons learned is acted upon; and

(z) requires complete testing, inspection and quality control activity records and reports to be prepared and maintained in accordance with Section B.6.2.6.

B.6.2.1.9 Design Builder shall promptly make all Quality Management System testing, inspection, and construction quality control records and reports

available to the City for inspection and review with reasonable notice and shall provide the City with a copy of those Quality Management System records when so requested.

B.6.2.2 Design Builder's Document Control

B.6.2.2.1 Design Builder shall maintain complete records of all tests, reports and other documentation pertaining to its Quality Management System to demonstrate the design and construction comply with the requirements of this DBA.

B.6.2.2.2 The Quality Management System shall include Design Builder's methods and systems for maintaining document control, including staff responsibilities.

B.6.2.2.3 Design Builder shall include in the Quality Management System its methods for staff checking out files and preventing data, plans, reports, correspondence, and Existing Infrastructure documentation related to the Infrastructure and other files and documents from being lost, stolen, or misplaced.

B.6.2.3 Design

B.6.2.3.1 The QMS shall require all designs, drawings, specifications and similar documents, for all aspects of the Project, be signed and sealed by a Professional of Record.

B.6.2.3.2 The QMS shall require two levels of design checks as listed below:

(a) the QMS shall require all design for the Project to be reviewed by a Professional Engineer who is not the Professional of Record. The review shall:

(i) confirm adequacy of overall design rationale and methodology;

(ii) complete a line-by-line review of all calculations and values;

(iii) confirm adequacy of modelling and simulations used to undertake design activities;

(iv) together with the Professional of Record, identify and resolve any non-conforming aspects of the design prior to issuance of the Design Submittal; and

(v) sign and seal all applicable Design Submittal along with the Professional of Record;

(b) the QMS shall require all design for the Project to be reviewed by the Independent Reviewer. The review shall:

(i) complete review of the design drawings including re-analysis of all aspects of the original design for all disciplines and operations and maintenance and safety;

(ii) complete review and re-analysis of all aspects of the original design, preferably (but not essentially) by a methodology other than that used in the original design to ensure that the design parameters are relevant;

(iii) confirm that the engineering drawings and construction specifications accurately convey the requirements of the original design;

(iv) confirm the completeness, integrity and accuracy of all aspects of the engineering drawings and construction specifications;

(v) together with the Design Manager, identify and resolve any non-conforming aspects of the design prior to issuance of the Design Submittal; and

(vi) provide documentation demonstrating the independent design reviews and analysis undertaken.

(c) the design checks shall be completed for any Post IFC Revisions as set out in Section C.1.3.22 of this Schedule 18.

B.6.2.3.3 Any inadequate design due to inappropriate or insufficient design rationale or methodology, calculations or translation into Design Submittals determined at any time, including after construction, shall be identified and reported by Design Builder and raised with the City Representative. Design Builder shall outline the necessary modifications and continue to monitor, to ensure the Work is in accordance with the Technical Requirements.

B.6.2.4 Construction

B.6.2.4.1 The QMS shall provide for ensuring that the Work is in conformance with the Technical Requirements and Final Design.

B.6.2.4.2 Construction works not conforming to the Technical Requirements and Final Design shall be identified and reported by Design Builder in accordance with Section A.4 of this Schedule 18. Design Builder shall undertake the necessary modifications and continue to monitor to ensure the Work conforms to the requirements of the Technical Requirements and Final Design.

B.6.2.4.3 Prior to Substantial Completion, the Engineer of Record, Quality Manager and Independent Quality Certifier shall be required to sign and seal a declaration that all Work has been constructed in accordance with the Final Design and Technical Requirements.

B.6.2.5 Testing and Inspection

B.6.2.5.1 In general, the QMS shall be designed in accordance with the CSA standards. For all construction materials and products, the QMS shall detail the testing and acceptance program, including the following:

(a) material property or characteristics to be measured or inspected;

(b) test methods and reference standards;

(c) testing frequency;

(d) inspection criteria and frequency; and

(e) criteria for product acceptance/rejection.

B.6.2.5.2 The QMS shall require complete testing/inspection reports be prepared for the Project, including all test results and inspection activities for all Work.

B.6.2.5.3 The QMS shall outline the extent to which Design Builder will undertake quality control and quality assurance activities, including testing and inspection, and how it will be implemented.

B.6.2.5.4 All Design Builder Parties responsible for testing and inspection shall be appropriately certified for the tests and inspection they are undertaking. Certification of the testing and inspection companies shall be in accordance with CSA or other governing bodies, for all aspects of the Infrastructure. Individual testers and inspectors shall conform to industry standard methods and specifications for undertaking their activities.

B.6.2.5.5 All testing and inspection documentation associated with quality control and quality assurance activities shall be made available to the City, via Schedule 13 – Document Management System, within 20 Business Days of the test or inspection or 5 Business Days of receipt from Design Builder Party testing or inspection personnel or entity, whichever is earlier.

B.6.2.6 Reporting

B.6.2.6.1 In the Monthly Project Report, Design Builder shall summarize the performance and efficacy of the Quality Management System and provide:

(a) a status update on the implementation of the Quality Management Plans;

(b) an explanation of any Quality Management System deficiencies identified and how they were resolved to ensure compliance with the Quality Management System;

(c) a description of the role and involvement of any self-certifying

Design Builder Parties and provision of the same information listed above for such Design Builder Party's quality management systems if Design Builder is relying upon them;

(d) a vendor and subcontractor quality management status report regarding integration of vendors and subcontractors with the QMS;

(e) a summary of any discrepancies identified as described in Section B.6.8;

(f) all Quality Management System testing, inspection, and construction quality control records and reports created or updated for the month. A certification by Design Builder's Quality Manager and the Independent Quality Certifier that work was performed is in accordance with the Quality Management System; and

(g) a certification by Professionals of Record responsible for review during construction that the work has been conducted in conformance with the design documents.

B.6.2.6.2 Within 1 year of the Effective Date and annually thereafter, Design Builder shall prepare and submit to the City an annual report on the performance and efficacy of the Quality Management System during the reporting period, such annual report to include:

(a) status update of Design Builder's Quality Management Systems and Plans;

(b) summary of all internal audits and external audits carried out;

(c) explanation of any non-conformances identified and any corrective measures implemented to ensure compliance with the Quality Management System and Technical Requirements;

(d) identification of any foreseeable and planned changes to Design Builder's Quality Management Systems and Plans;

(e) description of the role and involvement of any self-certifying Design Builder Party and provision of the same information listed above for such Design Builder Party's Quality Management Systems if Design Builder is relying upon them;

(f) declaration by the Independent Quality Certifier that work performed and reported in the quality assurance report is in accordance with the Quality Management System; and

(g) certification by Professionals of Record responsible for review during construction that the annual quality assurance report represents that the work was performed in accordance with the

design. Certification of the work to be provided in accordance with the requirements specified in this Section B.6.2.6, the requirements of the *Engineering and Geoscience Professions Act* (Manitoba), *Architects Act* (Manitoba) and any requirements of Governmental Authorities.

B.6.3 Quality Manager

B.6.3.1 Design Builder shall appoint a quality manager (the "**Quality Manager**") in accordance with B.7.3.2 to:

(a) develop, implement and oversee Design Builder's Quality Management System and Quality Management Plans;

(b) as part of the Monthly Project Report, prepare a quality management report in accordance with Section B.6.3.6;

(c) ensure that all tests and inspections are properly and thoroughly performed, documentation is provided and other quality management activities are completed in accordance with the DBA, Design Builder's Quality Management System and the Quality Management Plans;

(d) coordinate reporting in accordance with Section B.6.2.6;

(e) coordinate Engineer of Record review and acceptance reporting at specified milestones; and

(f) review and sign quality declaration acceptance reporting at specified Milestones.

B.6.4 Independent Quality Certifier

B.6.4.1 Design Builder shall appoint an Independent Quality Certifier to:

(a) review and oversee quality assurance aspects of Design Builder's QMS and Quality Management Plans;

(b) as part of the Monthly Project Report, prepare the quality assurance summary in accordance with Section B.8.5.2;

(c) report directly to the Design Builder Project Manager;

(d) review and approve all tests and inspections plans;

(e) provide monitoring and reporting on the performance of the QMS. Verify that the quality control and quality assurance functions are properly and thoroughly performed, documentation is provided, and other quality management activities are completed in accordance with the DBA, Design Builder's QMS and Quality Management Plans;

(f) review resolution to Non-Conformances and confirm corrective and

preventative actions are implemented;

(g) perform and coordinate QMS audits on behalf of Design Builder in accordance with the DBA, Design Builder's QMS and the Quality Management Plans;

(h) recommend, review and approve continuous improvement changes to Design Builder's QMS and Quality Management Plans;

(i) review and sign quality reports required under Section B.6.2.6; and

(j) review and sign quality declaration and acceptance reporting at specified Milestones.

B.6.5 Audit of Management Plans

B.6.5.1 Internal Audits

B.6.5.1.1 Design Builder shall, within one year of the Effective Date and annually thereafter, undertake an annual internal audit of the Quality Management System to verify that Design Builder is meeting the requirements of the Quality Management System and Quality Management Plans in its performance of the Work.

B.6.5.1.2 Design Builder shall undertake internal audits of Design Builder's Management Systems and Plans for the duration of the Project Term in accordance with ISO 9001:2018, ISO 14001:2015 and the COR program. The auditor shall follow the guidelines for Auditing Management Systems, ISO 19011:2018 standard, as amended or substituted from time to time. The audit shall, at a minimum, ensure that all input requirements are adhered to and that Design Builder's Management Systems and Plans are implemented and in compliance with the Design Build Agreement, requirements of ISO 9001:2015 standard, ISO 14001:2015 standard and the COR program as amended or substituted from time to time, and applicable regulatory standards. All elements shall be audited at least once per year.

B.6.5.1.3 Each internal Quality Management System audit shall include:

(a) document reviews and system audits to ensure that Design Builder has plans and procedures in place to cover all the required aspects of the Quality Management System; and

(b) compliance or procedural audits to ensure that Design Builder is effectively implementing the Quality Management Plans.

B.6.5.1.4 Upon completion of each audit pursuant to Section B.6.5.1, Design Builder shall:

(a) submit the results of the audit to City within 14 Calendar Days of the completion of the audit;

(b) address and implement appropriate corrective measures for all Quality Management System deficiencies identified by the audit, including any corrective measures reasonably required by the City, within 30 Calendar Days of the completion of the audit, unless otherwise agreed by the City; and

(c) submit to the City evidence of Design Builder's implementation of such corrective measures within 60 Calendar Days of the completion of the audit unless otherwise agreed by the City.

B.6.5.2 External Audits

B.6.5.2.1 In addition to the internal audits, Design Builder shall undertake external audits of Design Builder's Management Systems and Plans for the duration of the Project Term.

B.6.5.2.2 These external audits shall be conducted by an independent auditor certified by a known auditor registration body such as International Register for Certificated Auditors (IRCA), Registrar Accreditation Board (RAB), National Quality Institute (NQI) or other equivalent body. The auditor shall also be qualified to audit the scope of Design Builder's Management Systems and Plans. The audit process shall follow the guidelines for Auditing Management Systems, ISO 19011:2018, as amended or substituted from time to time.

B.6.5.2.3 The audit shall, at a minimum, ensure that all input requirements are adhered to and that Design Builder's Management Systems and Plans are implemented and in compliance with the Design Build Agreement, requirements of the ISO 9001:2015, ISO 14001:2015 and the COR program, as amended or substituted from time to time. A full system audit shall be completed within one year of signing the Design Build Agreement and thereafter at least once per year for the duration of the Project Term.

B.6.5.2.4 The results of the external audit shall be documented in an audit report and shall be submitted by Design Builder to the City Representative within 14 Calendar Days of audit completion.

B.6.5.2.5 All deficiencies identified by the external auditor during the audit shall be addressed, and corrective measures implemented by Design Builder within 30 Calendar Days following release of the audit report.

B.6.5.3 City-Directed External Audit

B.6.5.3.1 At any time and from time to time, the City or a City Party may carry out a full system external audit of the Quality Management System, or any part thereof, to verify that Design Builder is meeting the requirements of the Quality Management System and Quality Management Plans in its performance of the Works.

B.6.5.3.2 Design Builder shall make available to the City or City Party auditor all Quality Management System records relating to the Project. If the

external audit identifies Quality Management System deficiencies, the City will provide the results of the audit to Design Builder and Design Builder shall:

(a) address and implement appropriate corrective measures for all Quality Management System deficiencies identified by the external audit, including any corrective measures reasonably required by the City, within 30 Calendar days of Design Builder's receipt of the audit results unless otherwise agreed by City; and

(b) submit to the City evidence of Design Builder's implementation of such corrective measures within 60 Calendar Days of Design Builder's receipt of the audit results unless otherwise agreed by City.

B.6.5.4 Payment Adjustment

B.6.5.4.1 If Design Builder fails to implement appropriate corrective measures for all QMS deficiencies identified during an audit, in accordance with Sections B.6.5.1, B.6.5.2, or B.6.5.3, within 30 Calendar Days of receipt of the audit results, a Payment Adjustment will be assessed in accordance with Schedule 14 – Payment Adjustments.

B.6.6 Quality Control

B.6.6.1 Quality control shall be defined as the activities undertaken by Design Builder Parties to ensure the individual processes of the Work or components that comprise the final product of the Project are of sufficient quality to meet the requirements of the QMS, Final Design and the Technical Requirements.

B.6.6.2 Quality control is to be undertaken at the lowest level of activity with direction and oversight by the Quality Manager or designate. For example, quality control for reinforced concrete shall be completed by Design Builder Party responsible for construction of the reinforced concrete.

B.6.6.3 Individuals responsible for quality control shall be responsible for the daily quality management activities, including field testing, survey and layout, measurement, monitoring of construction activities, documenting and general observation.

B.6.6.4 Design Builder shall provide evidence on Design Builder's DMS or at the request of the City, within 1 Business Day, that the quality control activities are meeting the required frequencies, is being performed by qualified staff, and that the construction activities meet the required standard or specification and is within the specified tolerance. Whether evidence is requested or not, Design Builder shall provide evidence as part of its Monthly Project Report.

B.6.6.5 Design Builder shall assign at least one quality control individual for each asset of the Project as identified in Section A.2.1 of this Schedule 18. This quality control individual may be assigned to provide quality control duties for several components of the Project depending on the schedule and activities occurring at

those locations, provided they are able to fulfill the requirements of the QMS and Technical Requirements.

B.6.7 Quality Assurance

B.6.7.1 Quality assurance shall be defined as the activities undertaken by Design Builder Parties to verify the individual processes of the Work that comprise the final product of the Project are of sufficient quality to meet the requirements of the QMS, Final Design and the Technical Requirements.

B.6.7.2 Quality assurance shall be entirely separate and independent from the quality control activities and shall be led by the Independent Quality Certifier. Recognizing the IQC is not employed by any legal entity responsible for the Work, quality assurance personnel will be permitted to be from Design Builder or a Design Builder Party, provided they are able to satisfy the requirements of Section B.6.6 of this Schedule 18.

B.6.7.3 Quality assurance is to be undertaken at a higher level than quality control with direction and oversight by the IQC. For example, quality assurance for reinforced concrete shall be completed by a Design Builder Party not involved in the construction of the reinforced concrete. quality assurance is to be undertaken as an oversight and auditing role rather than an exhaustive quality management exercise as required for quality control.

B.6.7.4 Individuals responsible for quality assurance shall be responsible for reviewing, confirming and monitoring the activities of those responsible for quality control. This shall be achieved by also undertaking the daily quality management activities, including field testing, survey and measurement confirmation, monitoring of construction activities, documenting and general observation.

B.6.7.5 Through the daily management activities, the quality assurance personnel will be responsible for confirming quality control is achieving the required frequencies, being performed by qualified staff and the construction activities are conforming to the required standard or specification and is within the specified tolerance. This shall be achieved through the development of a summary report and submitted as part of the Monthly Project Report.

B.6.7.6 Design Builder shall assign at least one quality assurance individual for each asset of the Project as identified in Section A.2.1 of this Schedule 18. This quality assurance individual may be assigned to provide quality assurance duties for several components of the Project depending on the schedule and activities occurring at those locations, provided they are able to fulfill the requirements of the QMS and Technical Requirements.

B.6.8 Discrepancies

B.6.8.1 Discrepancies shall be considered as any testing or inspection where the findings between the quality control and quality assurance activities would mandate rejection over acceptance or would call into question the validity of the either of the quality management activities or quality of the Work.

B.6.8.2 All discrepancies shall be reviewed by the Quality Manager and the Independent Quality Certifier and the root cause shall be investigated, and appropriate corrective actions implemented.

B.6.8.3 All discrepancies shall be recorded in quality control and quality assurance quality management documentation, monitored and addressed in a timely manner.

B.6.8.4 Where immediate additional testing or inspection can verify the adequacy or rejection or the root cause can be readily determined, followed by the appropriate acceptance or rejection, the discrepancy will not require formal reporting. For example, during concrete testing a test could read insufficient plastic concrete properties for one quality management party. If both parties agree to reject the concrete, then the discrepancy is not necessary to report.

B.6.8.5 Notwithstanding Section B.6.8.4 of this Schedule 18, consistent discrepancies, regardless if properly accepted or rejected, shall be reported to the Quality Manager and the Independent Quality Certifier.

B.7 Resource Management

B.7.1 Resource Management Plan

B.7.1.1 Design Builder shall develop a comprehensive **Resource Management Plan**, as part of the overall Project Management Plan, that describes how physical and human resources will be allocated, managed, assessed and released and includes:

(a) identification of physical resources, including cranes, excavators, and other heavy equipment;

(b) identification of Project leadership in a project organization chart, a graphic display of Project team members and their reporting relationships;

(c) representation of all individuals identified in this Section B.7; and

(d) how Design Builder will demonstrate leadership and commitment to:

(i) enhancing City and stakeholder satisfaction; and

(ii) ensuring the Technical Requirements and Permits, Licences and Approvals are understood and consistently met by Design Builder Parties.

B.7.2 Key Individuals

B.7.2.1 For clarity, the Key Individuals listed in this Section B.7.2 are not intended to replace the Key Individuals listed in Schedule 6 – Subcontractors and Key Individuals. If Design Builder replaces a Key Individual, subject to Section B5 of the DBA, such replacement shall have the qualifications, as applicable to the Key Individual, as set out in this Section B.7.2.

B.7.2.2 Each of the Key Individuals that are indicated in Schedule 6 – Subcontractors and Key Individuals shall have as a minimum 10 years of experience in projects with the following characteristics:

(a) large municipal wastewater treatment plant project; ≥ $100 million CAD;

(b) municipal wastewater treatment capacity ≥ 200 ML/d average design flow;

(c) constructed in winter temperatures similar to that of Winnipeg; and

(d) design build or design build variation (such as DBO, DBFO, DBFMO and other Public – Private – Partnership (P3) projects) procurement method;

B.7.2.3 In addition to the qualifications above, the following specific qualifications are required for each Key Individual:

B.7.2.3.1 Design Builder Project Manager:

(a) experience with Canadian building codes and regulations;

(b) planned and managed construction with a large workforce of subcontractors and trades personnel;

(c) constructed deep pump station in artesian conditions;

(d) constructed in existing wastewater plant that operate continuously (24/7);

(e) performed horizontal tunneling in soft clay and artesian conditions;

(f) constructed multiple tie-ins of new wastewater infrastructure and ancillary systems into an existing plant; and

(g) conducted an effective safety health and environmental program; minimum accidents and lost time accidents Project Design Manager;

B.7.2.3.2 Project Design Manager:

(a) experience using quality management system in a DB or DB variation environment; and

(b) experience with Canadian building codes and regulations;

B.7.2.3.3 Lead Hydraulics Engineer:

(a) experience with Canadian building codes and regulations;

(b) designed raw sewage pump stations;

(c) designed upgrades to existing wastewater plant that operate continuously (24/7);

(d) performed HAZOP or other safety-in-design methodologies;

(e) incorporated operability and maintainability in the design;

(f) experience using quality management system in a DB or DB variation environment; and

(g) designed multiple tie-ins of infrastructure and systems to existing plant;

B.7.2.3.4 Lead Geotechnical Engineer:

(a) experience using quality management system in a DB or DB variation environment;

(b) excavations with aquifer and artesian conditions and associated solutions;

(c) deep excavations in firm to soft clays and associated solutions; and

(d) excavations where basal heave was a concern with associated solutions;

B.7.2.3.5 Lead Automation Engineer:

(a) design of instrumentation and controls for municipal wastewater treatment plant and facilities;

(b) proficiency in Schneider automation products;

(c) ability to troubleshoot automation systems;

(d) ability to manage and supervise systems integration; and

(e) experience in participation in HAZOP or other safety-in-design methodologies and failure mode and effects analysis;

B.7.2.3.6 Lead Electrical Engineer:

(a) design of electrical systems for municipal wastewater treatment plant and facilities;

(b) electrical experience in design of all voltage systems especially voltage systems ≤ 12.47kV;

(c) knowledge and proficiency in protection systems related to 12.47kV;

(d) ability to design synchronized multi-engine standby generator facilities;

(e) experience with electrical Canadian codes and regulations;

(f) ability to troubleshoot electrical systems; and

(g) critical planning capability with respect to connections in a continuously operating wastewater facility;

B.7.2.3.7 Lead Process Mechanical Engineer:

(a) experience with Canadian building codes and regulations;

(b) designed raw sewage pump stations, screening and grit removal systems;

(c) designed upgrades to existing wastewater plant that operate continuously (24/7);

(d) performed HAZOP or other safety-in-design methodologies;

(e) incorporated operability and maintainability in the design; and

(f) designed multiple tie-ins of infrastructure and systems to an existing plant;

B.7.2.3.8 Project Construction Manager:

(a) experience with Canadian building codes and regulations;

(b) planned and managed construction with a large workforce of subcontractors and trades personnel;

(c) constructed deep pump station in artesian conditions;

(d) constructed in existing wastewater plant that operate continuously (24/7);

(e) performed horizontal tunneling in soft clay and artesian conditions;

(f) constructed multiple tie-ins of new wastewater infrastructure and ancillary systems into an existing plant; and

(g) conducted an effective safety health and environmental program; minimum accidents and lost time accidents Project Design Manager.

B.7.3 Additional Key Individuals

B.7.3.1 The Quality Manager, Construction Superintendent, and Commissioning Lead shall also be considered as Key Individuals and listed in Schedule 6 – Subcontractors and Key Individuals

B.7.3.2 Quality Manager

B.7.3.2.1 Design Builder's Quality Manager shall meet the following qualifications:

(a) minimum of 5 years' experience in developing and implementing quality management systems and plans for design build projects of similar scope and nature; and

(b) served a similar role as the quality manager on a minimum of 2 design build projects.

B.7.3.3 Construction Superintendent

B.7.3.3.1 The individual designated as the Construction Superintendent shall meet the following qualifications:

(a) minimum 10 years' experience in leading a construction site on projects of similar size, scope and climate; and

(b) served a similar role as the Construction Superintendent on a minimum of 3 water or wastewater treatment projects.

B.7.3.4 Commissioning Lead

B.7.3.4.1 The individual designated as the Commissioning Lead shall meet the following qualifications:

(a) minimum 10 years' experience in conducting testing and commissioning on wastewater treatment facilities with similar processes, size and flow, and operating 24 hours a day, 7 days a week; and

(b) served a similar role as the Commissioning Lead on a minimum of 5 water or wastewater treatment plant projects.

B.7.3.4.2 Design Builder shall ensure that its commissioning team members have the necessary qualifications.

B.7.4 Other Project Individuals

B.7.4.1 Design Team

B.7.4.1.1 Design Builder shall appoint members of the Design Team as required to complete the design in accordance with the requirements of this DBA. Design Builder shall retain and maintain a team (the "**Design Team**") that:

(a) is qualified to perform the design based on design experience with facilities similar in scope, climatic conditions, nature and complexity to the Project;

(b) includes, as required by Applicable Law or Good Industry Practice, Professional Engineers, geoscientists and architects licensed in Manitoba;

(c) includes other qualified persons or professionals as required by Governmental Authorities and as required by this DBA;

(d) has expertise and experience to perform the design in a proper and professional manner to meet all requirements of this DBA; and

(e) undertakes and completes the responsibilities and duties as described in the *Engineering and Geoscientific Professions Act* (Manitoba) and the *Architects Act* (Manitoba).

B.7.4.2 HIRA Resource Requirements

B.7.4.2.1 Describe Design Builder's HIRA Team that will be responsible for carrying out the HIRA. Provide an organization chart identifying members of the HIRA Team and their qualifications, roles and responsibilities, that shall include at a minimum:

(a) HIRA lead;

(b) qualified person(s), as defined in WSHA;

(c) ergonomics lead who holds a Canadian Certified Professional Ergonomist designation;

(d) design HIRA representative(s);

(e) construction HIRA representative(s);

(f) operations and maintenance HIRA representative(s);

(g) handover HIRA representative(s); and

(h) additional resources when their specific expertise is required.

B.7.4.2.2 The City Representative may request changes to the HIRA Team if in the opinion of the City Representative, acting reasonably, members of the HIRA Team are not adequately qualified to meet their responsibilities, or the requisite subject-matter expertise is not represented on the HIRA Team. Design Builder shall not make changes to the HIRA Team without approval of the City Representative, that will not be unreasonably withheld.

B.7.4.3 HAZOP Resource Requirements

B.7.4.3.1 Describe Design Builder's HAZOP Team that will be responsible for carrying out the HAZOP, in accordance with the HAZOP Procedure included in Appendix 18D – City Standards and the HAZOP Guidelines;

B.7.4.3.2 Provide an organization chart identifying members of the HAZOP Team and their qualifications, roles and responsibilities, that shall include at a minimum:

(a) HAZOP facilitator;

(b) HAZOP facilitator shall have a minimum of 5 years' experience with wastewater treatment processes.

(c) design management HAZOP representative(s);

(d) process HAZOP representative(s);

(e) electrical HAZOP representative(s);

(f) automation HAZOP representative(s); and

(i) commissioning HAZOP representative(s);

(ii) plant operations HAZOP representative(s); and

(g) additional resources when their specific expertise is required.

B.7.4.3.3 The City Representative may request changes to the HAZOP Team if in the opinion of the City Representative, acting reasonably, members of the HAZOP Team are not adequately qualified to meet their responsibilities, or the requisite subject-matter expertise is not represented on the HAZOP Team. Design Builder shall not make changes to the HAZOP Team without approval of the City Representative, that will not be unreasonably withheld.

B.7.4.4 Asset Criticality Team

B.7.4.4.1 As part of the 30% Design Submittal, Design Builder shall submit to the City for review a description of Design Builder's team that will be responsible for carrying out the Failure Mode and Effects Criticality Analysis and other related Asset criticality tasks (the "**Asset Criticality Team**").

B.7.4.4.2 The Asset Criticality Team shall:

(a) be responsible for carrying out Asset criticality in accordance with Appendix 18H – Asset Registry; and

(b) include discipline representatives in which each Asset is categorized and other resources as required.

B.7.4.4.3 The City Representative may request changes to the Asset Criticality Team if in the opinion of the City Representative, acting reasonably, members of the Asset Criticality Team are not adequately qualified to meet their responsibilities, or the requisite subject-matter expertise is not represented on the Asset Criticality Team. Design Builder shall not make changes to the Asset Criticality Team without approval of the City Representative, that will not be unreasonably withheld.

B.7.4.5 Independent Quality Certifier

B.7.4.5.1 Design Builder's Independent Quality Certifier shall meet the following qualifications:

(a) is a registered professional and is not directly employed by any legal entity responsible for the Work;

(b) minimum of 7 years' experience in developing and implementing quality management systems and plans for design build projects of similar scope and nature;

(c) served a similar role as the Independent Quality Certifier or Quality Manager on a minimum of 2 design build projects; and

(d) completed ISO 9000 lead auditor training.

B.7.4.6 Safety Manager

B.7.4.6.1 Design Builder's safety manager shall meet the following qualifications:

(a) holds a degree in occupational health and safety or a Professional Engineer;

(b) certified by the Board of Canadian Registered Safety Professionals; and

(c) minimum of 5 years' experience in managing health and safety policies and procedures for large construction projects.

B.7.4.7 Environmental Manager

B.7.4.7.1 Design Builder's environmental manager shall meet the following qualifications:

(a) holds an environmental engineering degree and is a Professional Engineer, or holds an environmental science degree;

(b) certified environmental professional in environmental management by ECO Canada; and

(c) minimum of 5 years' experience in managing environmental impacts on large construction projects.

B.7.4.8 Operational Advisory Lead

B.7.4.8.1 Design Builder shall provide an Operations Advisory Lead individual for 1 year after Substantial Completion.

B.7.4.8.2 The Operations Advisory Lead shall have a minimum of 10 years of experience in process control and operations of wastewater treatment plants specifically in operation of:

(a) pumping stations;

(b) screens and screenings washer/compactors;

(c) grit removal equipment; and

(d) automatic control via PLCs and a PCS.

B.7.4.9 QMS Resource Requirements:

B.7.4.9.1 Design Builder shall provide sufficient QMS personnel to adequately implement the requirements of the QMS and Technical Requirements including:

(a) all staff responsible for quality management, including quality control, quality assurance, monitoring, auditing, checking and reviewing, and certification shall be listed in the QMS. All individuals shall report to the Independent Quality Certifier, Design Manager and Quality Manager as appropriate;

(b) all staff responsible for quality management shall have a full understanding of the QMS and Technical Requirements related to the assets they are responsible for inspecting. All necessary information shall be provided to the quality management personnel, including Design Submittals, standards, shop drawings, Documents, submittals, tolerances and any Post IFC Revision made throughout the Project Term;

(c) personnel responsible for quality management shall have a full understanding of the Project and have the required knowledge, experience and qualifications to adequately and effectively undertake quality management throughout the Project Term;

(d) quality management personnel not already listed in Section B.7 of this Schedule 18 shall have a full understanding of the QMS through training or technical training from a post-secondary institution. Quality management personnel shall provide certificates or other documentation validating the aforementioned training; and

(e) material testing laboratories and inspecting firms (e.g., welding inspection) shall be certified for the testing or inspection they are responsible for undertaking. All testing and inspection shall be in accordance with Good Industry Practice, including relevant standards and specifications.

B.7.4.10 Document Management System Team Requirements:

B.7.4.10.1 The Design Builder Document Management Team shall provide sufficient personnel to carry out the document management activities as set out in Schedule 13 – Document Management System. Refer to Schedule 13 – Document Management System for requirements for the DMS Team.

B.7.4.11 Qualified Professionals for Special Studies and Models

B.7.4.11.1 Design Builder shall provide qualified professionals to carry out the studies and models required by Appendix 18K – Special Studies and Models. Refer to Appendix 18K – Special Studies and Models for the required qualifications.

B.8 Communications Management

B.8.1 Communications Management Plan

B.8.1.1 The Project represents an important infrastructure commitment for the City. As Design Builder carries out its responsibilities under the Design Build Agreement, a comprehensive plan for communication is required to develop a robust and effective partnership between Design Builder and the City, based on core principles of transparency, openness, mutual respect and co-operation.

B.8.1.2 Design Builder shall prioritize creation of sound information and data as a central pillar of the transparency, openness and co-operation that all effective partnerships require.

B.8.1.3 Design Builder shall develop a comprehensive Communication Management Plan that ensures the information needs of the Project and its stakeholders are met through the development of artifacts (i.e. all forms of communication, e.g. deliverables, Documents, signage, website, etc.) and implementation of activities designed to achieve effective communication exchange.

B.8.1.4 The Communication Management Plan will support effective communications between Design Builder and the City, Design Builder Parties and other stakeholders.

B.8.1.5 The Communication Management Plan shall describe the process and methodology used by Design Builder to prepare all verbal, written and print and electronic communications related to planning, design, environmental assessments, environmental permits and approvals, construction, maintenance, operation, milestones, community and stakeholder relations, public presentations and open houses, public advertisements and mail drops, media responses, website information and social media updates for use by the City. For clarity,

pursuant to the restrictions set out in the Design Build Agreement, Design Builder shall not undertake any direct communication with the public and will solely be responsible to provide information to the City for their public communications.

B.8.1.6 Design Builder shall develop a comprehensive Communication Management Plan, as part of the overall Project Management Plan, that meets the requirements of Section B.8 of this Schedule 18 and include:

(a) the strategy and procedure to ensure external communication is effective between Design Builder and the City to establish a spirit of partnership;

(b) the strategy and procedure to ensure internal communication is effective between Design Builder Parties;

(c) what activities will be carried out to implement the communication external and internal strategy;

(d) the process for ensuring timely and appropriate collection, creation, distribution, storage, retrieval, management, monitoring and the ultimate disposition of Project information;

(e) the process of confirming the information needs of the Project and its stakeholders are met;

(f) the process for communicating Change Orders to internal Design Builder Parties;

(g) the process for ensuring City Representative directives are communicated to necessary Design Builder Parties; and

(h) how the document management requirements set out in Section B.8.2 of this Schedule 18 and Schedule 13 – Document Management System will be met.

B.8.2 Document Management Plan

B.8.2.1 Design Builder shall develop a comprehensive Document Management Plan (the **"Document Management Plan**") that meets the requirements of Schedule 13 – Document Management System, describes the Document Management System and how Project documentation will be communicated throughout the Project Term, including:

(a) a description of Design Builder's DMS software and its processes to access, view, organize, store, track, communicate and submit Documents and Project documentation;

(b) the strategy for ensuring that all Documents are submitted in accordance with Schedule 13 – Document Management System, including acknowledgement that the City has no responsibilities or obligations for Documents that do not follow this submission protocol;

(c) DMS Team requirements as set out in Section B.7 of this Schedule 18;

(d) the processes for Design Builder's DMS operations within Design Builder Parties;

(e) the processes for Design Builder's DMS operations with the City, including:

(i) a communication protocol with the City DMS Team and City Representative;

(ii) set up and ongoing provision of access for City DMS Team and City Party users;

(iii) procedure for submission of Documents; and

(iv) procedure for notification of Documents;

(f) the strategy to ensure data backups and DMS operations are maintained during Design Builder system outages; and

(g) delivery of City DMS Team and City Party user training as set out in Schedule 13 – Document Management System.

B.8.3 Team Building and Project Kickoff

B.8.3.1 Team Building Workshop

B.8.3.1.1 Design Builder shall facilitate a team building workshop between the Parties. The intent of this meeting is to establish, at a minimum, the purpose, scope, milestones, roles and responsibilities of Design Builder Parties and City Parties, from the beginning of the Project until acceptance. Design Builder shall prepare and issue an agenda 14 Calendar Days prior to the meeting.

B.8.3.2 Kickoff Meeting

B.8.3.2.1 Design Builder shall facilitate and host a kickoff meeting for the Project. Design Builder shall prepare and issue an agenda 14 Calendar Days prior to the meeting.

B.8.4 Project Meetings

B.8.4.1 Design Builder's responsibilities for Project meetings and workshops are described throughout the DBA. Design Builder shall be responsible for preparing and issuing an agenda, a minimum of 14 Calendar Days prior to each meeting. Design Builder shall be responsible for taking minutes and action items at each meeting. Design Builder shall issue the meeting minutes within 3 Business Days of the Project meeting to ensure timeliness and accuracy of project communication.

B.8.4.2 The City may return edits to the meeting minutes within 3 Business Days of receiving the meeting minutes from Design Builder. Design Builder shall incorporate the edits into the meeting minutes within 3 Business Days and redistribute.

B.8.4.3 Notwithstanding any other requirements for Project meetings, Design Builder shall organize and hold regular meetings between the City and Design Builder as follows:

(a) design and construction meetings:

(i) frequency shall be weekly;

(ii) suggested topics include:

(A) health and safety;

(B) Submittal status;

(C) RFI's, RFSs, NCR Plans;

(D) quality issues;

(E) Change Orders;

(F) Project Schedule;

(G) look-ahead;

(H) Milestones; and

(I) other topics as appropriate;

(b) Design Progress Meetings in accordance with Section C.1.5;

(c) Pre-Submittal Presentations in accordance with Section C.1.6;

(d) Design Submittal Review Workshops in accordance with Section C.1.7; and

(e) safety meetings in accordance with Section D.7.9.

B.8.5 Reporting

B.8.5.1 Design Builder shall prepare and submit to the City Representative a report (a "**Monthly Project Report**") summarizing the Work progress during the previous month.

B.8.5.2 The Monthly Project Report shall be organized as set out below and include the following information:

(a) scope:

(i) a summary of the Work progress completed to date, including individual WBS package completion and percent complete of each Milestone;

(ii) a narrative of the Work anticipated for the next month;

(iii) status of major design activities that significantly progressed or were completed during the month;

(iv) status of major construction activities that significantly progressed or were completed during the month;

(v) status of major testing and commissioning activities that significantly progressed or were completed during the month;

(vi) status of major training activities that significantly progressed or were completed during the month;

(vii) status of Permits, Licences and Approvals, which update will provide advance notice of any assistance that Design Builder requests from City pursuant to Section A.3.4;

(viii) status of health and safety with regard to orientation and training activities, leading and lagging indicators, safety statistics for accidents, near misses, inspection violations, safety reviews during the design development process including the HIRA, Asset criticality and HAZOP, and any Governmental Authority inspection reports and notices of compliance issued to Design Builder or any Design Builder Party;

(ix) status of Disputes and Relief Event claims, including date established, last action and date completed, and planned next action and date to complete;

(x) commentary on environmental management that includes:

(A) near-miss and incident investigation reports and a summary of actions taken or proposed by Design Builder or any Governmental Authority in respect of such near misses and incidents;

(B) results of environmental inspections;

(C) any Authority Having Jurisdiction inspection reports and notices of compliance issued to Design Builder or any Design Builder Party; and

(D) such other environmental information as the City requests from time to time.

(xi) commentary on health and safety management that includes all information required under Section D.7.8.

(b) schedule:

(i) graphical representation (S-curve) comparing the performance measurement baseline to the actual schedule performance (earned value analysis);

(ii) the schedule performance index (SPI);

(iii) identification of variances from Project Schedule;

(iv) an updated Project Schedule that meets the requirements set out in Section B.4.2 of this Schedule 18;

(v) an updated Training Schedule that meets the requirements in Appendix 18G – Training Requirements; and

(vi) an updated Submittal Schedule that meets the requirements set out in Schedule 5 – Review Procedure.

(c) cost:

(i) a summary of Change Orders, Change Order status and percent complete of each Change Order; and

(ii) a summary of Payment Adjustments in accordance with Schedule 14 – Payment Adjustments Section C.

(d) quality:

(i) a summary report on the performance and efficacy of the Quality Management System in accordance with Section B.6.2.6.1;

(ii) a summary of the quality control and quality assurance testing and inspection activities undertaken in accordance with Sections B.6.6.4 and B.6.7.5;

(iii) summary report of Non-Conformances during the month;

(iv) quality metrics including significant incidents, trends, preventative and corrective actions;

(v) status of quality management with regard to quality reviews conducted in design development, supplier activities, construction activities and for testing and commissioning activities;

(vi) as an appendix to the Monthly Project Report, a certification by the Quality Manager and Design Manager that the Work performed is in accordance with the Quality Management System,

Final Design and Technical Requirements; and

(vii) a summary of discrepancies identified in accordance with Section B.6.8;

(e) resources:

(i) summary of changes to Project personnel as set out in Section B.7 of this Schedule 18, if any;

(ii) summary of any changes to physical resources, such as heavy equipment; and

(iii) summary of Project team member training and development;

(f) communication:

(i) narrative of communication activities;

(ii) A digital album with monthly construction photographs showing the progress of construction throughout the reporting period, with all photos labelled with the date, location and description of the work;

(iii) A summary of any incidents and complaints recorded in the Incident Logging Centre along with Design Builder's actions in progress or completed in addressing those incidents and complaints; and

(iv) status of all Submittals in accordance with Schedule 5 – Review Procedure, by review category, listing title, revision number, latest date submitted, and status;

(g) risk:

(i) commentary on actions undertaken in response to risk events, including an update on events that were identified and submitted to the City via Relief Event Notices;

(ii) commentary on changes to the Risk Management Plan (e.g. identification of new risks, changes to probability or impact; etc.);

(iii) as an appendix to the Monthly Project Report, an updated risk register; and

(iv) status of risk management activities including major risk concerns and management strategies, and an updated risk register in accordance with Schedule 18 – Technical Requirements;

(h) procurement:

(i) commentary regarding implementation of the procurement management plan;

(ii) status of procurement of materials and significant equipment and material items that arrived during the month; and

(iii) key procurements made during this period (e.g. equipment purchases);

(i) stakeholders:

(i) a description of any upcoming activities requiring City input; coordination with the City; or coordination with stakeholders; and

(ii) a description of upcoming activities that impact the public or adjacent businesses (e.g. lane closures).

B.8.5.3 Payment Adjustment

B.8.5.3.1 Failure by Design Builder to submit a Monthly Project Report that includes all of the information required in Section B.8.5.2 of this Schedule 18, or failure to include sufficient detail in the Monthly Project Report to:

(a) accurately record the progress of the Works;

(b) allow the City to understand the planned progression of the Works; or

(c) allow the City to understand the coordination required between Design Builder and the City and/or plant staff in the following 3 months;

shall result in a Payment Adjustment in accordance with Schedule 14 – Payment Adjustments.

B.8.6 Incident Logging Centre

B.8.6.1 Throughout the Project until the Substantial Completion Date, Design Builder shall provide and maintain a central repository and database (the "**Incident Logging Centre**") for the Project in which Design Builder will record at a minimum all:

(a) reports, complaints and notices received from the City's 311 system, and from members of the public by telephone, e-mail, fax or other method, including noise, odour and traffic complaints;

(b) notices and communications received from any Governmental Authority;

(c) odour incidents;

(d) environmental incidents;

(e) security incidents;

(f) accident and emergencies; and

(g) safety incidents and near misses.

B.8.6.2 Include all incidents, reports, complaints and notices received from the City. Design Builder shall grant the City access to the Incident Logging Centre upon request.

B.8.6.3 Records

B.8.6.3.1 Design Builder shall record in the Incident Logging Centre all details relevant to each incident set out in Section B.8.6.1 and B.8.6.2, including the following information:

(a) Incident Logging Centre operator's name whom the report, complaint or notice was made or the automated electronic system that generated the report;

(b) name of the person making the report, complaint or notice;

(c) date and time;

(d) service, repair or correction required;

(e) description of the service failure, including the identification of the affected service area(s);

(f) full incident description;

(g) unique incident reference identifier;

(h) subcontractor and contact name to which the incident was passed, if applicable;

(i) date and time an incident was reported to the appropriate person for response, if applicable;

(j) action taken and by whom; and

(k) response time.

B.8.6.4 Features

B.8.6.4.1 Design Builder shall ensure the Incident Logging Centre meets the following performance requirements:

(a) generates a daily electronic log of all incidents logged in the

Incident Logging Centre;

(b) initiates first response procedures including raising alarms, reporting events to the City and applicable Governmental Authorities, including notifying the City prior to notifying Governmental Authorities; and

(c) prepares a weekly incident tracking summary of all incidents recorded in the Incident Logging Centre showing open and closed status.

B.8.6.5 Modification of the Incident Logging Centre

B.8.6.5.1 Design Builder shall not delete or alter any details recorded by the Incident Logging Centre unless it is approved in writing in advance by the City and the following information is recorded:

(a) exact nature and impact of the alteration or deletion;

(b) reason for the alteration or deletion; and

(c) name of the person who authorized the alteration or deletion.

B.8.7 Complaints and Notices

B.8.7.1 Design Builder shall not publicly respond to complaints or post public notices. Design Builder shall be responsible for taking corrective actions if the City deems a public complaint is valid. The City will respond to all public complaints and post public notices, as necessary.

B.8.8 Other Project Information

B.8.8.1 Design Builder shall provide any additional information upon request from the City Representative, all Parties acting reasonably.

B.9 Risk Management

B.9.1 Risk Management Plan

B.9.1.1 Design Builder assumes all risk as set out in Section B.6.5 of the Design Build Agreement.

B.9.1.2 In order to optimize Project success, Design Builder shall implement risk management to increase the probability/impact of positive risks and decrease the probability/impact of negative risks.

B.9.1.3 Design Builder shall develop and submit a plan for the management of anticipated Design Builder's Project risks (the "**Risk Management Plan**") in implementing the Project in accordance with the DBA, and consistent with Schedule 4 – Design Builder's Management Systems and Plans. The Risk Management Plan shall include:

(a) general approach to managing risk on the Project;

(b) the specific approaches, tools and data sources that will be used to perform risk management on the Project;

(c) the lead, support and risk management team members for each type of activity described in the Risk Management Plan, including descriptions of their responsibilities;

(d) internal protocols for the application and tracking of contingency funds;

(e) the risk categories used on the Project (e.g. technical risk, management risk, commercial risk, external risk, etc.);

(f) definitions of risk probability and impacts;

(g) probability and impact matrix; and

(h) how the outcomes of the risk management will be documented, analyzed and communicated, including the content and format of the risk register and the risk report.

(i) A process for identifying, categorizing, and registering risks in a risk register in an orderly manner;

(j) Evaluating all risks for their related probability to actually occur, and their potential cost and schedule impact if the risk occurs. Adjust, monthly, the risk probabilities and potential impacts, regardless of higher or lower, as the Works progress;

(k) Implement a system to easily identify risks with a potentially higher impact and medium to high probability of occurrence;

(l) Develop specific management strategies to avoid, insure and / or mitigate risks to proactively and effectively manage risks;

(m) Monitor effectiveness of management strategies and adjust such strategies accordingly to maintain effective control of risks; and

(n) Provide and review an updated risk register with the City on a monthly basis, unless the Parties agree on another schedule, to highlight changes in Design Builder's risk probabilities, potential impacts, and management strategies.

B.10 Procurement Management

B.10.1 Procurement Management Plan

B.10.1.1 Design Builder shall develop a comprehensive Procurement Management Plan, as part of the overall Project Management Plan, that meets the requirements of

Section B.10 of this Schedule 18, specifies procurement approaches and documents project procurement decisions and includes:

(a) the methodology for procurement decisions (e.g. evaluation criteria related to price, quality, experience, etc.);

(b) the process for monitoring Design Builder Party contract performance, making changes and corrections as appropriate and closing out contracts;

(c) approach to including applicable Design Build Agreement requirements (e.g. Technical Requirements) and adherence to Design Builder's Management Systems and Plans (e.g. quality management, communication protocols, etc.) in procurement contracts;

(d) strategies employed with key procurements to achieve effective partnerships; and

(e) procedures to identify additional insurance requirements based on country of origin; and if such insurance is required, procedures for notifying the City of the need for additional insurance prior to shipment of equipment.

SECTION C. DESIGN REQUIREMENTS

C.1 General

C.1.1 General Responsibilities

C.1.1.1 Design Builder shall undertake the design in accordance with all requirements of this DBA and shall prepare all documentation necessary or appropriate to carry out and complete the design in accordance with the DBA.

C.1.1.2 Design Builder shall carry out the design as required by each provision of this Schedule 18 and its appendices whether or not the provision is written as an obligation of Design Builder or is stated in the imperative form.

C.1.1.3 Design Builder shall be responsible for other supplementary investigations as required to complete its designs in a professional and competent manner. This may include; Permits, Licences and Approvals, environmental considerations, topographic survey, condition assessments, hydraulic and hydrologic investigations, additional geotechnical investigation and other investigative surveys.

C.1.1.4 The performance requirements to be met in the design of all Infrastructure include requirements in the areas of safety, functionality/serviceability, durability/maintainability, accessibility design, crime prevention through environmental design and aesthetics. The minimum standards for these performance requirements are specified in the Technical Requirements and the appended documents. If a performance requirement is not specified in the Technical Requirements, the performance requirement shall be set to Good Industry Practice.

C.1.1.5 All designs shall incorporate appropriate transitions between the Infrastructure and Existing Infrastructure. Design Builder shall avoid segmented or disjointed transitions such that it appears as patch work.

C.1.1.6 Design Builder shall be responsible for completing the design of all elements of the Works, in accordance with the DBA, including final geotechnical, hydrogeological and environmental investigations, Governmental Authority requirements (including the finalization and issuance of the Permits, Licences and Approvals) all technical analysis required to design the Infrastructure, and design quality control and quality assurance in accordance with Good Industry Practice. In preparing Design Builder's Design for the Works, Design Builder shall comply with the Technical Requirements.

C.1.1.7 The design requirements are generally specified in the Technical Requirements. If a requirement is not specified in the Technical Requirements, Design Builder shall adhere to:

(a) Good Industry Practice, while considering local conditions, including but not limited to:

(i) minimum and maximum outdoor temperature;

(ii) long term exposure to sunlight and atmospheric pollutants;

(iii) wind speed and direction;

(iv) soil composition; and

(v) groundwater;

(b) the requirements of any applicable Governmental Authority;

(c) Applicable Law; and

(d) Permits, Licences and Approvals.

C.1.1.8 Design Codes and Manuals

C.1.1.8.1 Design Builder shall be responsible for ensuring all design completed for the Work is in accordance with the latest edition (plus interims) of all design codes and manuals. Unless expressly stated otherwise, each reference to a standard in this document shall be deemed to mean the latest version of that standard as of the Submission Deadline of Design Builder's proposal in response to the RFP.

C.1.1.8.2 Design Builder shall be responsible for tracking revisions (and interims) of all design codes, manuals, guidelines and standards.

C.1.1.8.3 Design Builder shall keep the City regularly advised as to potential changes to design codes, manuals, or standards affecting the Project of which Design Builder has knowledge and provide recommended

responses to such potential changes so as to mitigate any possible adverse economic impact on the City should a change to design codes, manuals, or standards actually occur.

C.1.1.8.4 Where a version change (and interims) for a design code, manual or standard occurs after the Effective Date, Design Builder shall notify the City should the change affect the design materially.

C.1.1.9 Area Codes

C.1.1.9.1 The Technical Requirements, and especially the process functional requirements in Appendix 18A – Process Functional Requirements, have used the Area Codes in accordance with the Document Numbering Standard found in Appendix 18D – City Standards. These Area Codes should be used as a guide. However, if Design Builder desires to modify and update the Area Codes and the processes contained within the areas Design Builder shall submit the proposed changes to the City for review in accordance with the RFS procedure. Proposed changes to Area Codes, if applicable, shall be submitted to the City for review prior to submission of the 30% Design Submittal. The Area Codes anticipated for this Project are:

(a) Area H: Headworks Facility;

(b) Area P: Primary Clarification Facility;

(c) Area C: Centrate Treatment Facility;

(d) Area G: Standby Generation Facility and Existing Grit Removal Facility;

(e) Area Y: Yard;

(f) Area E: Electrical Building and Substation; and

(g) Area M: Main Building.

C.1.2 Design Phases

C.1.2.1 Design Builder shall undertake the Design in progressive phases, that shall include the following (each a "**Design Phase**"):

(a) 30% design phase;

(b) 60% design phase;

(c) 90% design phase; and

(d) Issued for Construction (IFC) phase.

C.1.2.2 Each Design Phase shall further develop the information and detail submitted in a previous Design Phase.

C.1.2.3 Design Builder shall submit each Design Phase submittal in accordance with Schedule 5 – Review Procedure.

C.1.3 Design Submittals

C.1.3.1 Design Builder shall prepare design documentation to meet the performance outputs and other specific requirements of the DBA. The Design Phase submittal ("**Design Submittal**") shall include as a minimum the information set out in Appendix 18N – Design Submittal Requirements, unless otherwise approved by the City. If Design Builder has previously submitted any Submittals required to be included in a Design Submittal as set out in Appendix 18N – Design Submittal Requirements, Design Builder shall also include each such Submittal with the applicable Design Submittal so that each Design Submittal is comprehensive.

C.1.3.2 Current Design Submittals shall not reference sections in previous Design Submittals. Information in previous Design Submittals that is relevant to the current Design Submittal shall be included in the current Design Submittal so that previous Design Submittals do not need to be opened to understand the current Design Submittal.

C.1.3.3 The Design Submittal shall ascertain that Design Builder is conforming to the Technical Requirements.

C.1.3.4 The Design Submittal contents identified in Appendix 18N – Design Submittal Requirements are the minimum the City needs to review and does not relieve Design Builder of any other obligation within the DBA to provide a complete design or to submit other information as contemplated by this DBA.

C.1.3.5 Design Builder shall submit the various parts of the Design Submittal in reasonable packages to allow for City review in accordance with Schedule 5 – Review Procedure. Notwithstanding, once each part has achieved an endorsement of "Received", in accordance with Schedule 5 – Review Procedure, Design Builder shall submit the Design Submittal, in accordance with Schedule 5 – Review Procedure as one complete document.

C.1.3.6 Design reports for all aspects of the Infrastructure shall include the decision process, criteria, assumptions, design notes, design codes, design loads, material information, material codes and general information regarding the component and elements of the Infrastructure used for each aspect of the design, construction staging plans, Permits, Licences and Approvals and special construction requirements. The design reports shall also include the design models (Revit, CADD and models found in Appendix 18 K), in their native digital file format.

C.1.3.7 Design Builder shall align the naming used in the Design Submittal with the *Identification Standard* provided in Schedule 18D - City Standards.

C.1.3.8 Design Submittal drawings shall be prepared in accordance with formats and standards reflected in Appendix 18C – Drafting Requirements.

C.1.3.9 Provide comprehensive construction specifications sufficiently detailed to describe the process or end result requirements in accordance with Appendix 18B – Specifications.

C.1.3.10 The Design Submittals shall be uploaded to the document management system in accordance with Schedule 13 – Document Management System.

C.1.3.11 At least 10 Business Days before commencing work on a design report for a Design Submittal, Design Builder shall submit a draft table of contents to the City. The table of contents shall be used to develop the design report.

C.1.3.12 Submittals transmitted to the City before the IFC Submittal shall be in sufficient detail to clearly demonstrate that the design complies with the requirements of the DBA. The IFC Submittal shall be a comprehensive progression of all previous Design Submittals and shall strictly comply with the DBA.

C.1.3.13 After Design Builder has obtained an endorsement of “Received” on the IFC Submittal for each design package submission, Design Builder shall prepare Issued for Construction Documents based on the IFC Submittal. The title block on all Issued for Construction Documents shall be marked as “Issued for Construction”.

C.1.3.14 Design Builder shall organize submission of sections of the Design Submittals in a manner that is conducive to review by the City. This may require the submission in a sequence or in parallel, as appropriate. For example, the drawings associated with a specific section of the design report shall be submitted with written sections that reference the drawings.

C.1.3.15 Design Builder shall provide design calculations with a Design Submittal at the written request of the City, except as expressly stated in the Technical Requirements.

C.1.3.16 30% Design Submittal:

C.1.3.16.1 The 30% Design Submittal shall include the information set out in Appendix 18N – Design Submittal Requirements.

C.1.3.16.2 Design Builder shall submit the 30% Design Submittal as a single package for review by the City.

C.1.3.17 60% Design Submittal:

C.1.3.17.1 The 60% Design Submittal shall include the information set out in Appendix 18N – Design Submittal Requirements.

C.1.3.17.2 Design Builder may submit multiple 60% Design Submittals, divided into logical design packages, for review by the City. The Submittal Schedule shall demonstrate when each design package will be submitted.

C.1.3.18 90% Design Submittal:

C.1.3.18.1 The 90% Design Submittal shall include the information set out in Appendix 18N – Design Submittal Requirements.

C.1.3.18.2 Design Builder may submit multiple 90% Design Submittals, divided into the same logical design packages as the 60% Design Submittals, for review by the City. The Submittal Schedule shall demonstrate when each design package will be submitted.

C.1.3.19 Issued For Construction Submittal:

C.1.3.19.1 The IFC Submittal shall include the information set out in Appendix 18N – Design Submittal Requirements

C.1.3.19.2 Design Builder may submit multiple IFC Submittals, divided into the same logical design packages as the 90% Design Submittal, for review by the City. The Submittal Schedule shall demonstrate when each design package will be submitted.

C.1.3.20 The provision of the Design Submittals as set out in Section C.1.3.1 of this Schedule 18 does not relieve Design Builder to develop the submittals and construction methodology documents (e.g. product information, shop drawings, etc.) stipulated in the comprehensive construction specifications and submit to the Professional of Record for review in accordance with Design Builder's QMS.

C.1.3.21 Revisions from Previous Submittals

C.1.3.21.1 With each Design Submittal, Design Builder shall provide a log of all changes from the previous Design Submittal, with the exception of the 30% Design Submittal which will not have a previous submission. The City will not commence their review of the Design Submittal as set out in Schedule 5 – Review Procedure until the provision of this change log. For clarity, the time-frames set out in Schedule 5 – Review Procedure will not commence until the City has received the change log.

C.1.3.21.2 Drawings that form part of the Design Submittal shall also follow the revision requirements in Section D.2 in Appendix 18C – Drafting Requirements.

C.1.3.21.3 With the exception of any substitutions or variances permitted by the City stemming from a RFS, any Design Submittal that materially deviates from the previous submission will be considered a Non-Conformance and Design Builder will be responsible to correct and rectify such deviations and re-issue that Design Submittal.

C.1.3.22 Post Issued For Construction Revisions

C.1.3.22.1 After Design Builder has submitted an IFC Submittal for a component of the Work, any changes that would impact or modify the design of that or any other component of Work shall be captured in a Post IFC Revision

and submitted to the City for review in accordance with Schedule 5 – Review Procedure. For clarity, impacts or modifications to the design shall be considered by any changes to the design concepts, design details, specifications, materials and construction methods and techniques.

C.1.3.22.2 The design checks as set out in Section B.6.2.3.2 of this Schedule 18 shall also be completed for any Post IFC Revision.

C.1.3.22.3 With respect to the time-frames for the City's review in accordance with Schedule 5 – Review Procedure, a Post IFC Revision will be treated as an IFC Submittal.

C.1.3.22.4 Design Builder shall clearly identify (i.e. cloud) the portions of the Post IFC Revision that have been revised.

C.1.3.22.5 In addition to the summary of changes in the change log, as set out in Section C.1.3.21.1 of this Schedule 18, Design Builder shall include a short description of what necessitated the changes included in the Post IFC Revision.

C.1.3.22.6 Design Builder shall submit the full document associated with the Post IFC Revision. For example, if there is changes to 1 page in a 15-page Design Submittal package, the entire 15-page package shall be submitted for City review.

C.1.3.22.7 Design Builder shall not proceed with the changes to the Work included in the Post IFC Revision until the City's review in accordance with Schedule 5 – Review Procedure has been completed.

C.1.3.22.8 After Design Builder has obtained an endorsement of "Received" on the Post IFC Revision, Design Builder shall prepare and any Issued for Construction Documents based on the Post IFC Revision.

C.1.3.23 Underground Structures Branch

C.1.3.23.1 Design Builder shall coordinate with City of Winnipeg Underground Structures Branch for review of its designs.

C.1.3.23.2 Design Builder shall investigate and address all potential conflicts and concerns identified by the Underground Structure Branch review.

C.1.4 Design Management Office

C.1.4.1 Design Builder shall establish an office ("**Design Management Office**") in a single location, within the City limits within 60 Calendar Days after the Effective Date until the Final Completion Date. The Design Management Office shall include space for the City and City Parties for their use until Substantial Completion, as follows;

- [redacted] 2 cubicles;

(b) access to a lunchroom;

(c) access to washrooms; and

(d) telephone, internet, WIFI, VOIP, miscellaneous digital services, printer, photocopier, and scanner.

C.1.4.2 Design Builder shall provide, for part-time use by the City and City Parties a meeting room. The meeting room shall be a minimum of 20 m^2 and seat six people around a boardroom table and include a conference station phone. Priority use shall be given to the City and City Parties.

C.1.4.3 All Design Progress Meetings, Pre-Submittal Presentations, and Design Review Workshops shall occur at the Design Management Office unless otherwise agreed to by the City.

C.1.4.4 Design Builder shall provide work space for design management, design and support staff. Although the design leads are not required to work in the Design Management Office, teleconferencing and occasionally travelling to the Design Management Office will be required to adequately interface with the City and City Parties. Design Builder shall bear the cost for all teleconferencing hardware and software and any travel by its employees. Design leads not located in the Design Management Office shall report to the Design Management Office at the request of the City, acting reasonably, and at no extra cost to the City.

C.1.5 Design Progress Meetings

C.1.5.1 Design Builder shall cause its Design Team to meet with the City for design reviews at Design Builder's Design Management Office from the Effective Date until Design Builder has submitted and achieved an endorsement of "Received" in relation to the IFC Submittal. Design Builder shall plan the agenda for each Design Progress Meeting. The City may also provide topics to be covered as part of the design reviews, upon request.

C.1.5.2 The purpose of the design reviews will be to review the progress of design and assess compliance of Design Builder's Design with the requirements of the DBA. The design reviews will include an "over the shoulder" collaborative review of Design Builder's 3-D model once a month (or at such other frequency as may be agreed to between the City and Design Builder) and allow the City to provide informal feedback to Design Builder.

C.1.5.3 Design Builder shall provide additional information at the City's request in accordance with Schedule 13 – Document Management System.

C.1.5.4 Design Progress Meetings may also be used for covering specific topics such as HIRA, Asset criticality and HAZOP.

C.1.6 Pre-Submittal Presentations

C.1.6.1 Design Builder shall organize and hold at its Design Management Office formal and facilitated presentations ("**Pre-Submittal Presentations**") with the City at the end of each Design Phase prior to submission of the Design Submittal.

C.1.6.2 The Pre-Submittal Presentations will allow Design Builder to present design information to the City to enhance the City's understanding of the design as well as allow the City to provide informal feedback to Design Builder on the draft Design Submittal.

C.1.6.3 City's participation in Pre-Submittal Presentations does not change or reduce Design Builder's sole responsibility for the accuracy, completeness and integrity of the design to perform as required by the Technical Requirements.

C.1.7 Design Submittal Review Workshops

C.1.7.1 Design Builder shall organize and hold at its Design Management Office workshops to review the City's comments on Design Submittals to facilitate understanding and responding to the City's comments through the CRS ("**Design Submittal Review Workshops**"):

(a) within 5 Business Days of having a Design Submittal endorsed as "Observations" or "Comments" in accordance with Schedule 5 – Review Procedure, unless otherwise agreed to by the Parties.

C.1.8 Security Sensitive Work

C.1.8.1 Should a situation arise, the City, acting reasonably, may designate any portion of the design as security sensitive work, that shall be subject to the following restriction:

(a) all design materials pertaining to security sensitive work shall be kept confidential and only released to those persons who have been cleared by the City Representative.

C.1.9 Design Changes

C.1.9.1 Revisions to drawings and specifications under the processes described in this Schedule and in Schedule 5 – Review Procedure shall not be considered a Change Order and shall be completed at Design Builder's cost.

C.1.9.2 Changes to the Technical Requirements shall be implemented only by way of the change process described in Schedule 17 – Change Orders.

C.1.9.3 Any field changes to the design, including changes, corrections or supplemental information to facilitate construction after issuance of the Issued for Construction Documents shall be tracked by Design Builder in accordance with the Design Management Plan, with specific notice to the City, and shall be approved by the Professional of Record. Field changes that alter the Technical Requirements will not be permitted, except pursuant to Schedule 17 – Change Orders.

C.2 Design Management Plans

C.2.1 General

C.2.1.1 The design management plans described in this Section C.2 shall form part of Schedule 4 – Design Builder's Management Systems and Plans. Updated and revised plans shall supersede previous versions.

C.2.1.2 The design management plans, including any updated and revised plans, shall be reviewed in accordance with Schedule 5 – Review Procedure.

C.2.1.3 Design Builder shall revise and update the design management plans as required to reflect any changes to the management of the design of the Infrastructure. Design Builder shall, at a minimum, provide the City with an annual update to the design management plans.

C.2.2 Design Management Plan

C.2.2.1 Design Builder shall develop and submit a plan for the management of the Design Team and design process (the "**Design Management Plan**") that includes:

(a) a comprehensive plan detailing the methodology Design Builder will adopt to manage the Design Team and design process and ensure that it complies with the Technical Requirements and the Design Quality Management Plan;

(b) an organization chart, including identification of the Engineer of Record, all Design Team members, key discipline design leads on the Project and the Professional of Record for each discipline consistent with Schedule 4 – Design Builder's Management Systems and Plans;

(c) a definition and explanation of the roles and responsibilities within Design Builder's team for performing the design work including members of the core Design Team, locally based staff and other Design Builder Parties involved in carrying out the Design;

(d) a description of the progressive phases of the design, including the Design Phases set out in Section C.1.2

(e) a schedule for all main design activities, including studies and models, in accordance with Appendix 18K – Special Studies and Models, site survey, and site investigations, consistent with Schedule 4 – Design Builder's Management Systems and Plans;

(f) the contents and format of each Design Submittal;

(g) scope control and design input verification procedures;

(h) processes and procedures to ensure that all Design Submittals are reviewed by an Independent Reviewer;

(i) processes and responsibilities for ensuring that engineering and architectural drawings, specifications and related documents are stamped and signed by the Professional of Record;

(j) a drawing tree indicating the organization and hierarchy of all design drawings and the approach to be used for document control through all phases of the design and construction and responsibilities for ensuring that engineering and architectural drawings, specifications and related documents conform to the requirements of any applicable Governmental Authority, Applicable Law, City Standards, applicable Permits, Licences and Approvals and the Technical Requirements;

(k) the CRS procedure as required by Schedule 5 – Review Procedure;

(l) coordination with the Quality Management System;

(m) details of the plans for implementing and verifying the implementation of the design throughout construction, including a communications plan on how changes will be managed and how City will be informed of these changes;

(n) procedures for implementation of 3-dimentional drawings and modelling on the Project, including compliance with Appendix 18C – Drafting Requirements and Appendix 18D – City Standards; and

(o) appropriate metrics to measure the progress of the design activities for each design discipline and plant area.

C.2.3 Permitting Management Plan

C.2.3.1 Builder shall develop and submit a plan (the "**Permitting Management Plan**") that includes:

(a) a comprehensive description of how Design Builder will comply with its obligations under Section A.3.4;

(b) procedures for managing all communications and submittals to the relevant Governmental Authorities, including consultation, formal applications and the review process through to receipt and maintenance of the Permits, Licences and Approvals;

(c) a detailed listing of all expected Permits, Licences and Approvals and the expected review times by the Governmental Authority;

(d) Design Builder's approach to phasing Permit, Licences and Approvals for phased construction;

(e) the quality management procedures for ensuring that all Permits, Licences and Approvals applications and submittals are fully complete, and that the information submitted is accurate and correct;

(f) the roles and responsibilities of Design Builder Parties for performing the permitting work;

(g) a description of each of the main risks that Design Builder foresees in securing the Permits, Licences and Approvals in a timely manner and the mitigation strategies that Design Builder will adopt;

(h) the format of the monthly permitting and approval progress reports to be submitted to City until all Permits, Licences and Approvals are obtained and all of the conditions of the Permits, Licences and Approvals have been discharged; and

(i) completion of City signatures a minimum of 30 Calendar Days before submission; where the Permits, Licences and Approvals must be obtained under the City's name.

C.2.3.2 At least 90 Calendar Days before the Scheduled Substantial Completion Date, Design Builder shall update the Permitting Management Plan to include:

(a) the establishment of a Permits, Licences and Approvals registry;

(b) processes and procedures for managing and maintaining the Permits, Licences and Approvals registry to ensure that it is kept up to date;

(c) procedures to ensure that all of Permits, Licences and Approvals are kept in good standing;

(d) procedures for all data gathering, testing, report preparation and collation of any other information required to obtain and maintain all required Permits, Licences and Approvals;

(e) procedures for renewing Permits, Licences and Approvals as required;

(f) permitting progress and compliance reporting to indicate the current status of permits; and

(g) list of Permits, Licences and Approvals that are required for the service life of the Infrastructure, including renewal periods.

C.2.3.2.1 Submit the updated Permitting Management Plan for review by the City in accordance with Schedule 5 – Review Procedure.

C.2.4 Decommissioning Plan

C.2.4.1 Design Builder shall prepare and submit a decommissioning plan (the **"Decommissioning Plan"**). The Decommissioning Plan shall include:

(a) the scope of the existing facilities that are not required as part of the Infrastructure in Design Builder's Designs nor required by the City to be maintained in service for the benefit of third parties or to maintain the Permits, Licences, and Approvals;

(b) site plans clearly indicating which assets will be decommissioned;

(c) a description of the timing and methods that will be used to implement the decommissioning for Existing Infrastructure to undergo decommissioning;

(d) a hazardous materials removal plan including the methods and safety measures that will be implemented; and

(e) a description of the impacts or potential impacts that decommissioning may have on facilities to be reused or new facilities and how these impacts will be mitigated such that the Existing Infrastructure not being decommissioned and Infrastructure remains in continuous operation.

C.2.4.2 At least 180 Calendar Days before the day on which Design Builder anticipates achieving Performance Testing Completion Design Builder shall further develop an updated version of the Decommissioning Plan that shall include:

(a) an updated scope defining the existing facilities that are not required as part of the Infrastructure in Design Builder's Designs nor are required by the City to be maintained in service for the benefit of third parties or to maintain the Permits, Licences, and Approvals;

(b) updated listing and site plans clearly indicating which assets will be decommissioned;

(c) a detailed schedule of the timing for decommissioning activities;

(d) detailed description of sequencing of decommissioning activities;

(e) detailed description of the impacts that decommissioning will have on Existing Infrastructure to be reused and how these impacts will be mitigated such that the Infrastructure remains in continuous operation;

(f) detailed methods for decommissioning activities; and

(g) maintenance manuals consistent with Appendix 18F – O&M Information for facilities, buildings, structures, HVAC systems, etc. that will be decommissioned and need to be maintained.

C.2.4.3 Design Builder shall update the Decommissioning Plan, as necessary, and resubmit to the City.

C.2.5 Prevention Through Design Plan

C.2.5.1 Design Builder shall develop and implement a plan to prevent hazards and promote a safe working environment in the design of the Infrastructure (the "**Prevention Through Design Plan**"), which shall include:

(a) identify and carry out a risk assessment of all hazards at the Infrastructure in accordance with Section C.5.3;

(b) achieve a risk rating of each hazard for which the residual risks are acceptable in the relevant setting in accordance with Section C.5.3.

(c) minimize the occurrence of occupational injuries, illnesses and fatalities;

(d) minimize the presence of hazardous area classified spaces;

(e) identify areas with potential for hazardous conditions including the buildup of temperature or poisonous and explosive gases and provide appropriate sensors connected to the PCS to autonomously monitor these areas;

(f) deter, detect, diminish or eliminate security risk to individuals, utilities, assets and information, and prepare for, respond to and recover from an emergency;

(g) identify and incorporate ergonomic design principles and minimize the risk factors for musculoskeletal injury;

(h) set out an internal review process through which Design Builder shall ensure:

(i) risk assessments have been completely appropriately, by qualified safety personnel, and meet City Standards;

(ii) facilities and equipment are built and installed in accordance with safety and security design requirements, ergonomic design principles, and emergency management protocols;

(iii) required documents are identified, produced and submitted to City Representative for review;

(iv) all work procedures, testing and related training are adequate and completed before commissioning or sooner as set out in the Technical Requirements; and

(v) reviews are conducted and recommendations implemented through all phases of the Work in accordance with Good Industry Practice and as set out in the Technical Requirements.

C.3 Technical Design Plans

C.3.1 General

C.3.1.1 The technical design plans shall be submitted in accordance with Appendix 18N – Design Submittal Requirements.

C.3.2 Noise Control Plan

C.3.2.1 Design Builder shall prepare and submit a comprehensive noise control plan for the Infrastructure (the "**Noise Control Plan**") in accordance with Appendix 18N – Design Submittal Requirements. The Noise Control Plan shall include:

(a) all reasonable steps to minimize noise from daily operation of the Infrastructure and, without limiting the foregoing, shall comply with Applicable Law, including City By-laws;

(b) demonstrate that noise levels from daily operation of the Infrastructure after completion of the upgrade, measured at the NEWPCC legal boundary, are limited to the noise standards in Section C.3.2;

(c) demonstrate that, notwithstanding Section C.6, noise levels measured at the exterior of any building constructed under this DBA, or in an outdoor region of the Infrastructure frequented by plant staff, will not exceed 85 dBA; and

(d) demonstrate that noise levels in all areas frequented by third parties including truck bays, delivery areas, etc., do not exceed 85 dBA at any time.

C.3.3 Equipment Lifting and Replacement Plan

C.3.3.1 Design Builder shall develop and submit a plan (the "**Equipment Lifting and Replacement Plan**") that provides a description of the equipment lifting, removal and replacement strategy for each piece of equipment, including hatches and covers, greater than 25 kg and that demonstrates the strategy meets the Technical Requirements. The Equipment Lifting and Replacement Plan shall include the following at a minimum:

(a) a summary of the equipment lift and replacement requirements set out in the Technical Requirements;

(b) a summary of lifting equipment in the Infrastructure (permanent and portable), including location, type, capacity and equipment to be removed/installed;

(c) locations of removable louvres and panels that will be used to remove (and replace) equipment and a description of procedures and location of cranes and any temporary structures that will be required to be erected to facilitate removal and replacement of equipment (in the future);

(d) access corridors for equipment lifting and replacement including:

(i) corridors for routing equipment and supplies from roadway entrance to area within the Infrastructure where it is used;

(ii) corridors for pallet lifting devices, wheeled A-frames, gantry cranes, trollies carts and other mobile equipment for equipment or supplies delivery/removal to demonstrate a minimum clearance of 600 millimetres on all sides;

(iii) corridors for motorized fork lifts for equipment or supplies delivery/removal to demonstrate a minimum clearance of 600 millimetres on all sides; and

(iv) vertical shaft corridors for lifting equipment and supplies between each level in the Infrastructure, including the type of equipment employed to provide the lift.

(e) for each piece of equipment greater than 25 kg describe:

(i) the number of lifts required to remove the equipment;

(ii) the access corridors within the Infrastructure that will be used to remove the equipment;

(iii) demonstrate that clearance and turning radii requirements are met, means of removing the equipment from buildings/structures and landing it on a truck for transport off site and the means of installing new replacement equipment in the future; and

(iv) locations on the Lands that will be used for a mobile crane to remove equipment from process tanks, rooftop of buildings and other structures.

C.3.4 Subsurface Investigation Plan

C.3.4.1 If Design Builder requires additional geotechnical or hydrogeological information to carry out its design, Design Builder shall develop, implement, maintain and, as in-situ conditions require, update a Subsurface Investigation Plan (SIP). The SIP must demonstrate the methods, measures and processes that Design Builder will implement, as Design Builder deems necessary to meet the requirements of the Project as set out in this DBA, to better understand and define the subsurface conditions to be taken into account in the design and the construction. The "**Subsurface Investigation Plan or SIP**" at a minimum, shall include the following information:

(a) summary of information gathered from Appendix 18S – Geotechnical Investigations and additional information the Design Builder requires to carry out its design;

(b) the specific geotechnical testhole locations;

(c) the frequency and type of soil sampling;

(d) the specific standpipe and monitoring well locations;

(e) instrumentation types and specific locations;

(f) the frequency and type of field testing;

(g) the type of laboratory testing;

(h) the schedule for implementation of the SIP;

(i) the locations, procedures and processes to implement the investigations;

(j) the methods, policies and procedures to be implemented to ensure that all investigations and related activities are:

(i) conducted in accordance with all applicable Permits, Licences and Approvals, agreements, plans and Applicable Law; and

(ii) completed in accordance with the SIP Schedule;

(k) the hydrogeology specific aspect of the investigation including:

(i) geologic and soil conditions;

(ii) type, stratification and thickness of soil involved in excavation and dewatering; and

(iii) delineation of the thickness and boundaries of major geologic and soil formations showing irregularities in the geologic profile;

(l) criticality including:

(i) damage to excavation or foundation in event of failure; and

(ii) rate of rebound;

(m) groundwater or piezometric pressure characteristics including:

(i) groundwater table or hydrostatic pressure in site area and its source;

(ii) variation with river stage, season of year, etc.;

(iii) type of seepage (artesian, gravity, combined); and

(iv) chemical characteristics and temperature of groundwater; and

(n) permeability including:

(i) determination of permeability from field pumping tests.

C.3.5 Excavation, Shoring and Dewatering Plan

C.3.5.1 Design Builder shall develop, implement, maintain and update, as *in situ* conditions require, an "**Excavation, Shoring and Dewatering Plan**" in accordance with Appendix 18N – Design Submittal that demonstrates the methods, measures and processes of excavation, shoring support and dewatering that Design Builder will implement as part of the construction. Design Builder shall include, at a minimum, the following information in the Excavation, Shoring and Dewatering Plan:

(a) an assessment of the impact from the staged dewatering required to facilitate earthworks;

(b) an estimate of groundwater abstraction volume and piezometric drawdown, and the design methods that satisfy Manitoba Sustainable Development and the City of Winnipeg;

(c) a complete description of the design of all components of excavation, shoring and dewatering (including design methods, criteria and assumptions);

(d) the construction methodology of all aspects of excavation, shoring and dewatering (including equipment, construction procedures, materials and personnel);

(e) the quality management of excavation, shoring and dewatering, including displacement, settlement and groundwater monitoring (quantity and quality), including allowable movement criteria, notification and action reporting thresholds, in accordance with geotechnical and hydrogeological instrumentation and monitoring requirements in accordance with quality management requirements set out in Section B.6 of this Schedule;

(f) management procedures that will be used in the event process fluids from the Existing Infrastructure leak into the excavation, including notifying the City and managing potentially contaminated water in the excavation;

(g) the quality management of dewatering, including groundwater monitoring, shall be performed in accordance with:

(i) groundwater exploration permits and drainage and water control licensing of the *Water Rights Act* (Manitoba Sustainable Development);

(ii) Manitoba Water Quality Standards, Objectives and Guidelines of the *Water Protection Act* (Manitoba Sustainable Development); and

(iii) City of Winnipeg Sewer By-Law No.92/2010 or subsequent versions, Part 8 Discharges of Land Drainage.

(h) specifications for excavation, shoring and dewatering systems;

(i) procedures for the decommissioning and removal of those parts of the shoring and dewatering systems that are required to be removed by Applicable Law, or otherwise under this DBA;

(j) all other information necessary to demonstrate that the proposed methods, measures and processes of excavation, shoring and dewatering set out in the Excavation, Shoring and Dewatering Plan are in accordance with the requirements of this DBA, including this Schedule;

(k) the Excavation, Shoring and Dewatering Plan shall be sealed in accordance with the applicable requirements of Engineers Geoscientists

Manitoba;

(l) Design Builder shall provide a detailed plan and operation schedule for dewatering of excavations including, at a minimum, the following information:

(i) the purpose of dewatering;

(ii) the descriptive literature of the dewatering system;

(iii) a plan showing the work location and proposed discharge location;

(iv) a description of dewatering techniques to be employed;

(v) the anticipated dewatering flow rate, duration and total volume;

(vi) the methods to be used to monitor the performance of the dewatering system during the progress of the work;

(vii) a plan describing modifications that may be required to assure that the systems shall perform satisfactorily;

(viii) an assessment of water quality, including prior water testing results conducted by Design Builder, for sediment and other pollutants defined in the Groundwater Acts, Provincial Guidelines and City of Winnipeg By-Law;

(ix) the water collection and storage options (if applicable);

(x) the water re-use options, including a feasibility study of reuse of the groundwater conducted by Design Builder;

(xi) the water treatment options, including methods and technologies for sediment and other pollutants removal;

(xii) a discharge disposal plan, ensuring the discharge is disposed of in a suitable manner without damage to adjacent properties or facilities;

(xiii) a plan for erosion and sedimentation control during dewatering; and

(xiv) copies of all Permits, Licences, and Approvals required for the disposal and discharge of water during dewatering.

C.3.6 Land Drainage Management Plan

C.3.6.1 Design Builder shall:

- provide a comprehensive land drainage management plan (the "**Land**

Drainage Management Plan") including design briefs, outline specifications and associated drawings for the overall land drainage system and retention/detention facilities design to meet the requirements of the *WSTP Civil Design Guideline*;

(b) provide a hydraulic analysis and final design of land drainage sewer system, open channels, and storage facilities by using hydrograph method such as SWMM modeling software;

(c) provide detailed drawings and specifications for the proposed land drainage system, and retention/detention storage facilities;

(d) control discharge rates to the John Black land drainage sewer along Main Street to not exceed 0.19 m^3/s. Design Builder shall verify the maximum allowable discharge rate with the Governmental Authority prior to preparation of the Land Drainage Management Plan; and

(e) provide a land drainage sewer system with a single new connection to the John Black drainage system along Main Street. Design Builder shall not design a land drainage sewer system that connects to the NEWPCC's existing land drainage sewers.

C.3.7 Tie-Ins Plan

C.3.7.1 Design Builder shall develop a plan to tie-in new infrastructure to Existing Infrastructure or Existing Infrastructure into new infrastructure (the "**Tie-Ins Plan**"), that shall include the sequence of the tie-ins. The Tie-Ins Plan shall explain for all tie-ins, at a minimum:

(a) the schedule for the tie-in;

(b) the procedure for completing the tie-in, and how it minimizes disruptions to plant operations and ensures conformance with the *Environment Act Licence No. 2684 RRR*;

(c) the duration of plant shutdown required to perform the tie-in;

(d) an emergency back-up plan, in the event that the tie-in procedure is delayed, and plant shutdown would have to be extended to complete the tie-in;

(e) construction, process upset or operational risks that may result in delaying the tie-in procedure and how these risks will be mitigated or controlled; and

(f) safety risks associated with each tie-in procedure and how they will be mitigated or controlled.

C.3.7.2 At a minimum, the following tie-ins shall be addressed in the Tie-Ins Plan:

(a) interceptors to junction chamber/raw sewage pump station;

(b) headworks to primary influent channel or grit effluent channel;

(c) headworks overflow to outfall;

(d) new potable water systems to existing supply;

(e) new land drainage sewers to existing land drainage sewers;

(f) new sanitary sewer to existing sewers;

(g) new flushing water system to existing system;

(h) standby generators to existing power supplies;

(i) Existing Infrastructure to new power supplies;

(j) new boilers to natural gas supply; and

(k) fiber network.

C.3.7.3 For other Tie-ins, Design Builder shall provide information in the Tie-In Plan in accordance with Section C.3.7.

C.3.8 Alarm Management Plan

C.3.8.1 The Alarm Management Plan shall be developed in consultation with the City during development and shall be submitted to the City for review in accordance with Schedule 5 – Review Procedure. The Alarm Management Plan shall include at a minimum:

(a) the philosophy of the alarm system;

(b) the procedures for alarm identification, rationalization, detailed design, and implementation;

(c) procedures for monitoring and assessment of alarms; and

(d) change management procedures, including the procedures for changing set points and dead bands as well as creating and deleting alarms.

C.3.8.2 Design Builder shall utilize and involve process engineers in the development of the alarm management plan.

C.4 Design Criteria

C.4.1 Basis of Design and Performance Requirements

C.4.1.1 Design Flows and Loads Design Builder shall design the Infrastructure to accept and operate efficiently under the full range of influent flow conditions from startup to Year 2037 design values set out in Table 1. Design Builder shall determine parameters and related design values not listed in Table 1 as appropriate for the

design, construction and operation of the Infrastructure in accordance with this Section C. Design Builder acknowledges and accepts that the flows to the NEWPCC may vary slightly from those listed in Table 1 during commissioning, and the Final Design shall account for this variability.

C.4.1.2 Design Builder shall account for all return flows and the character of such return flows in the design of the Infrastructure, including the sludge drying bed forcemain flow.

Table 1: Raw Sewage Influent Design Flows

Flow	Startup	Design Value (Year 2037)
Minimum instantaneous flow, ML/d	53	53
Minimum day flow, ML/d	107	134
Minimum week flow, ML/d	121	154
Annual average flow, ML/d	192	236
Maximum month flow, ML/d	400	485
Peak wet weather flow, ML/d	1,056	1,056
Future peak wet weather flow, ML/d	1,250	

C.4.1.3 Design Builder shall design the unit processes, equipment and components in the Infrastructure based on the most stringent of the flow and load requirements.

C.4.1.4 Design Builder shall conduct sensitivity analyses on the design by varying the values described in Table 1 to satisfy itself and the City of the robustness of the design.

C.4.1.5 Treatment Standards

C.4.1.5.1 Design Builder shall design and construct the Infrastructure to meet the performance standards set out in this Section C.4.1.5 (collectively the "**Treatment Standards**").

C.4.1.5.2 The Infrastructure shall produce residuals with the following qualities:

(a) screenings that meet or exceed the following requirements:

(i) has a slump of less than < 150 millimetres and is suitable for landfill disposal in accordance with *Environment Act Licence No. 3081 R*;

(ii) washed to minimize any residual organics;

(iii) dewatered dry solids content meeting the Process Performance Guarantees; and

(iv) is stored in a dedicated bin for removal to the landfill;

(b) grit that meets or exceeds the following minimum requirements:

(i) has a slump of less than < 150 millimetres and is suitable for landfill disposal in accordance with *Environment Act Licence No. 3081 R*;

(ii) washed to minimize any residual organics;

(iii) VS content of TS meeting the Process Performance Guarantees;

(iv) compacted and dewatered to a dry solids content meeting the Process Performance Guarantees; and

(v) is stored in a dedicated bin for removal to the landfill;

(c) the Infrastructure shall treat odourous emissions to the following requirements (collectively the “Odour Standard”):

(i) maximum odour concentration is 5 odour units (defined under European Standard EN 13725) at the 99.5th percentile over a 10-minute interval, measured anywhere along the NEWPCC legal boundary and at any receptor outside the NEWPCC legal boundary;

(d) demonstrate the Odour Standard by air dispersion modelling as required by Appendix 18K – Special Studies by:

(i) modelling the discharge from the stacks(s) provided by the Design Builder;

(ii) excluding from the dispersion model, odours not emitted from the stack(s) provided by the Design Builder; and

(iii) verifying Design Builder’s design assumptions by field sampling of the stack emission and running the air dispersion model with real field data as inputs to the model.

(e) the Infrastructure shall meet the following noise requirements:

(i) comply at all times with the following sound levels, as measured at the boundary of the NEWPCC Facility:

(ii) no more than 65 dBA between the hours of 7:00 a.m. and 9:00 p.m.; and

(iii) no more than 60 dBA between the hours of 9:00 p.m. and 7:00 a.m.

C.4.1.6 Hydraulic Design

C.4.1.6.1 Design Builder shall design the Infrastructure in accordance with the hydraulic design criteria set out in this Section.

(a) influent arriving via the three main interceptor sewers shall be conveyed to the wet well of the raw sewage pumping station, which shall have a maximum high water level equivalent to existing surge well water level of 221.77 m, adjusted for additional headloss by new piping to new wet wells;

(b) the raw sewage pumping station shall lift the influent to the screenings and grit removal facilities at a sufficient elevation to feed the reused primary clarifiers by gravity, and the new overflows by gravity;

(c) provide sufficient number of pumps and speed range to span the range of minimum and maximum flows, with sufficient standby units for redundancy at the raw sewage pumping station;

(d) the performance characteristics of the pumping stations shall be demonstrated by physical model testing before final design and construction in accordance with Appendix 18K – Special Studies and Models;

(e) all flow splitting, load splitting, and flow and load splitting systems and devices for parallel treatment systems, sub-systems, processes, trains and equipment shall meet the following requirements:

(i) the actual flows immediately downstream of a splitting system shall be equal, with a maximum variance of 5 percent relative to each other;

(ii) all fluids entering the splitter shall be completely mixed before leaving the flow splitter, i.e. the loads (concentrations) of the constituents in each exiting stream shall match that of the entering stream, with a maximum variance of 5 percent relative to each other;

(iii) in cases where a flow or load splitter is user adjustable then (i.e. if the flow is meant to be distributed in any proportion other than equally to the destination processes), the actual flows and loads for each exiting stream shall not vary from the intended proportion more than 5 percent relative to each other;

(iv) the above requirements shall be demonstrated by

computer and physical model testing before final design and construction in accordance with Appendix 18K – Special Studies and Models and demonstrated in the field prior to Substantial Completion;

(v) overflows shall be sized to convey the specified flows to the specified destinations by gravity at the specified river, and plant water levels. Use passive systems. Overflows, bypasses, and diversions shall be designed for the flow rates specified in Appendix 18A – Process Functional Requirements;

(vi) maintain a minimum 700 mm freeboard in all open channels and tanks under average flow conditions, and in no case less than 150 mm under the peak flow conditions;

(vii) hydraulic design shall take account of both static and dynamic flow regimes where applicable.

C.4.1.7 Hydraulic Profile

C.4.1.7.1 Design Builder shall prepare 'normal' hydraulic profiles from the raw sewage pumping station wet well to the existing primary influent channel at annual average flow and maximum month flow, as shown in Table 1, at a UV discharge channel (downstream of weir) of 229.46 m. The hydraulic profile at maximum month flow shall be at Firm Capacity (i.e. all standby or redundant units of each process out of service);

C.4.1.7.2 Design Builder shall also prepare ‘abnormal' hydraulic profiles. Specifically these shall show pumped flows of 705 ML/d, 860 ML/d, 1056 ML/d, and 1250 ML/d with 380 ML/d to secondary treatment and the excess diverted to the appropriate overflows, at a UV discharge channel (downstream of weir) of 229.46 m;

C.4.1.7.3 Each hydraulic profile shown shall be accompanied by supporting calculation spreadsheets, annotated and complete for ease of review;

C.4.1.7.4 The hydraulic profile drawings shall show all relevant elevations, and the following:

(a) high and low water levels at the upstream and downstream of each process tank, conduit, channel, junction chamber, flow control structure, baffle, launder, and pipe;

(b) flow through each process tank, conduit, channel, junction chamber, flow control structure, baffle, launder, and pipe including all recycle flows, supplemental flows, sidestream flows, and sludge flows for both solids and liquid streams;

(c) number of units in service and number of units out of service at each unit process;

(d) invert, floor, and top-of-wall elevations of process tanks, conduits, pipes and channels;

(e) invert and crown elevations of pipes;

(f) weir and flume elevations, with upstream and downstream high and low water levels;

(g) all gravity overflows, bypasses and diversions. Show all associated flow control devices; and

(h) pumps, mixers, airlift pumps, aeration systems, and other mechanical devices affecting flow volume, distribution, water level, or any other hydraulic function.

C.4.1.8 Process Flow Description

C.4.1.8.1 Design Builder shall design the treatment processes for the Infrastructure in accordance with the following unit processes:

(a) for the liquid treatment system, provide raw wastewater pumping followed by screening and grit removal; and

(b) for foul air streams, provide extraction from process areas and treatment as follows:

(i) minimum two stage odour control system for all other emission sources comprising a minimum of a bioscrubber followed by biofilter.

C.4.1.9 Proven Technologies

C.4.1.9.1 Design Builder shall not use unproven processes, equipment, systems and/or technologies.

C.4.1.10 Design for Expandability

C.4.1.10.1 Design Builder shall consider that the NEWPCC may require future expansions due to increased development in the NEWPCC catchment area and shall generally consider the need for expansion of the Infrastructure. Design Builder shall design and construct the Infrastructure such that the City will have the capability of expanding or constructing similar processes adjacent to the Infrastructure in the future.

C.4.1.10.2 Design Builder shall refer to Appendix 18A – Process Functional Requirements for specific expandability requirements.

C.4.2 Special Studies and Models

C.4.2.1 Design Builder shall cause the Professional of Record and/or qualified professionals to:

(a) undertake special studies and models in accordance with Appendix 18K – Special Studies and Models to demonstrate that Design Builder's Design meets the requirements of the DBA; and

(b) submit all special studies and models (including all draft and final studies, models, reports and other submittals set out in Appendix 18K – Special Studies and Models to the City for review in accordance with Schedule 5 – Review Procedure.

C.4.2.2 In addition to any other restrictions set out in Appendix 18K – Special Studies and Models, Design Builder shall not commence any construction of any areas, systems or components of the Infrastructure that are the subject of or affected by a special study or model set out in Appendix 18K – Special Studies and Models until the City has assigned a "Received" comment to the applicable draft study or model and associated draft report in accordance with Schedule 5 – Review Procedure.

C.4.2.3 Study and Model Approach Brief

C.4.2.3.1 Before performing any special study or model set out in Appendix 18K – Special Studies and Models, Design Builder shall submit to the City for review in accordance with Schedule 5 – Review Procedure an approach brief detailing the names and qualifications of the Professional of Record and/or qualified professionals who will perform the special study or model, scenarios that will be analyzed, methods that will be used, expected accuracy, critical assumptions, software that will be used, and an anticipated list of outputs from the study or model.

C.4.3 Master Equipment Schedule

C.4.3.1 Design Builder shall prepare a master equipment schedule ("**Master Equipment Schedule**") for equipment, instrumentation, controls and appurtenances included in the Infrastructure.

C.4.3.2 The Master Equipment Schedule shall include all process equipment, including all equipment and instrumentation appurtenances upstream and downstream of process equipment, including isolation valves, sampling ports, check valves, flow meters, variable frequency drives, vibration sensors, temperature sensors, level transmitters and other similar devices that are required by the Technical Requirements.

C.4.3.3 The Master Equipment Schedule shall also include all electrical and instrumentation and control equipment supplied with vendor packages. Submit the Master Equipment Schedule in accordance with Appendix 18N – Design Submittal Requirements.

C.4.3.4 The Master Equipment Schedule shall be consistent with P&IDs and other documents submitted with the As-Built Submittal.

C.4.3.5 Design Builder shall create a Master Equipment Schedule template that:

(a) has a database structure compatible with City systems and applications;

(b) incorporates all applicable City Standards;

(c) has functionality with pre-defined blocks to develop the Master Equipment Schedule;

(d) has quality control data checking; and

(e) has pre-defined reports and output files compatible with City systems and applications.

C.4.3.6 Design Builder shall cause all equipment shown on the Master Equipment Schedule to be reflected on project documentation, deliverables, nameplates and other Submittals as required to name or identify equipment or spaces within the Infrastructure and to be consistent with the City Standards.

C.4.4 Hazardous Locations

C.4.4.1 Design Builder shall design the Infrastructure to minimize the number of hazardous locations such that:

(a) plant staff would not be required to follow a SWP and wear PPE to protect against hazardous gases;

(b) equipment can be easily accessed for maintenance and repair; and

(c) electrical equipment is not required to be classified.

C.4.4.2 Design Builder shall designate areas within the Infrastructure as hazardous locations according to the nature of the hazard.

C.4.4.3 Design Builder shall design the Infrastructure in accordance with zone classification system as per CEC. Design Builder shall use NPFA 820 in the manner described in the *WSTP Building Mechanical Design Guideline* in Appendix 18D – City Standards in determining area classifications and is responsible for determining the equivalent zone classification defined in CEC.

C.4.4.4 Design Builder shall provide area classification drawings showing the classification of each space as defined by the Canadian Electrical Code and the application of NFPA 820 parameter as stated in Section C.4.4.3.

C.4.4.5 Class I Hazardous Location Requirements

C.4.4.5.1 Design Builder shall design Class I hazardous locations to meet the most stringent requirements of the *WSTP Building Mechanical Design Guideline* in Appendix 18D – City Standards, the CEC and the Governmental Authorities.

C.4.4.5.2 Refer to Section C.11 of this Schedule for additional HVAC requirements.

C.4.4.6 Extent of Class I Hazardous Location Classification

C.4.4.6.1 Design Builder shall designate the extent of the hazardous location in accordance with the more stringent of:

(a) Applicable Law;

(b) as set out in NFPA 820;

(c) as set out in NFPA 497; and

(d) as required to suit Design Builder's Final Design.

C.4.4.7 Class II Hazardous Requirements

C.4.4.7.1 Design Builder shall designate Class II hazardous locations in accordance with Applicable Law. Design Builder shall designate the extent of hazardous location in accordance with NFPA 499 - Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.

C.4.4.8 Entry/Exits to Mechanical Rooms, Electrical Rooms and Shops

C.4.4.8.1 Design Builder shall ensure that the entries to and exits from all mechanical rooms, electrical rooms, shops, washrooms, first aid rooms and other amenities are from an unclassified space.

C.4.5 Asset Service Life

C.4.5.1 Design Builder shall:

(a) select equipment that will result in a low cost of ownership and reduce overall life cycle costs;

(b) select equipment that is suitable for its intended use and life, reliable, durable, easy to maintain, has a proven track record, has good product support and has the minimum service life set out in Table 2 without requiring repair or replacement based on the maintenance requirements; and

(c) as requested by City, provide satisfactory evidence that the predicted service life of an asset can be achieved using the methodology set out in Table 2.

Table 2: Asset Service Life

Assets	Minimum Service Life	Maintenance Requirements	Methodology for Predicting Service Life
Primary Road	As per *WSTP Civil Design Guideline*	None	Good Industry Practice
Secondary Road	As per *WSTP Civil Design Guideline*	None	Good Industry Practice
Water retaining structures and dry flood proofed structures	As per *WSTP Structural Design Guideline*	None	ACI 365.1R Service Life Prediction
Concrete protective liners (HDPE/PVC)	40 years	None	Good industry practice
Fiberglass, aluminum and stainless steel covers	30 years	None	Good Industry Practice
Buried utilities: gravity sewer pipes (PVC, concrete, or HDPE)	100 years	Good Industry Practice	Good Industry Practice
Transmission pipelines and yard piping (PVC or HDPE pipelines under pressure)	100 years	Good Industry Practice	Good Industry Practice
Building structural elements	80 years	None	CSA S478 Guidelines on Durability in Buildings
Foundation elements and substructures	160 years	None	CSA S478 Guidelines on Durability in Buildings
Louvers	30 years	None	CSA S478 Guidelines on Durability in Buildings
Unitized glazing	25 years (glass and seal) 30 years (frame system)	None	CSA S478 Guidelines on Durability in Buildings
Doors	30 years	None	CSA S478 Guidelines on Durability in Buildings
Roofing covering systems	30 years (EPDM membrane systems) 40 years (metal roofs)	None	CSA S478 Guidelines on Durability in Buildings
Elevators	30 years	As recommended by manufacturer	CSA S478 Guidelines on Durability in Buildings
Process mechanical equipment (indoor dry, indoor wet, outdoor – refer to Appendix 18B – Specifications)	25 years	As recommended by manufacturer	Good Industry Practice
Process mechanical equipment (submerged, process corrosive, headspace, chemical corrosive – refer to Appendix 18B – Specifications)	15 years	As recommended by manufacturer	Good Industry Practice

Assets	Minimum Service Life	Maintenance Requirements	Methodology for Predicting Service Life
Diesel storage tanks (aboveground/underground)	30 years	As recommended by manufacturer	Good Industry Practice
Process piping	25 years	None	Good Industry Practice
Process valves and slide gates	25 years	As recommended by manufacturer	Good Industry Practice
HVAC equipment	30 years	As recommended by manufacturer	CSA S47 Guidelines on Durability in Buildings
Plumbing	25 years	None	CSA S478 Guidelines on Durability in Buildings
Protective coatings for concrete in process areas	15 years	None	Good Industry Practice
Electrical distribution equipment	40 years	As recommended by manufacturer	Good Industry Practice
Power transformers	40 years	As recommended by manufacturer	Good Industry Practice
Dry type transformers	40 years	As recommended by manufacturer	Good Industry Practice
Lighting fixtures and poles (excluding drivers and sources)	40 years	None	Good Industry Practice
LED lighting sources	L_{70} >= 80,000 hours	None	IES LM-80-15, IES TM-21-11
LED drivers	60,000 hours	None	Manufacturer stated rating
Lighting control equipment	30 years	As recommended by manufacturer	Good Industry Practice
Electronic devices that are part of buildings systems (security, intrusion detection, access control)	20 years	As recommended by manufacturer	Good Industry Practice
Fire alarm system field devices	30 years	As recommended by manufacturer	Good Industry Practice
Battery inside equipment (battery bank, equipment backup power supply)	10 years	As recommended by manufacturer	Manufacturer stated rating
Bulk battery in rack (120 VDC switchgear power, large UPS)	20 years	As recommended by manufacturer	Manufacturer stated rating
Grounding systems	50 years	None	Good Industry Practice
Instrumentation	20 years	As recommended by manufacturer	Good Industry Practice
Field hardware	15 years	As recommended by manufacturer	Good Industry Practice
PCS servers and work stations	10 years	As recommended by manufacturer	Good Industry Practice
Network equipment	15 years	As recommended by manufacturer	Good Industry Practice

C.5 Design for Safety

C.5.1 Design Builder's General Responsibilities

C.5.1.1 Design Builder shall:

(a) design and construct the Infrastructure so as to meet or exceed the requirements laid out in WSHA and its associated regulations;

(b) develop a structured approach during the design development process to address safety as an integrated element;

(c) identify all hazards at the Infrastructure and eliminate or reduce residual risks in accordance with Good Industry Practice and as set out in the Technical requirements;

(d) provide the Submittals set out in this Section to:

(i) fully document how safety elements have been addressed as part of the design development process;

(ii) provide justification for decisions and safety provisions included in Design Builder's Design; and

(iii) demonstrate compliance with this Section.

C.5.2 Prevention Through Design

C.5.2.1 Design Builder shall submit a Prevention Through Design Plan as set out in Section C.5.2.

C.5.2.2 Design Builder shall use as part of the design development process a rigorous and systematic prevention through design approach to prevent occupational injuries, illnesses and fatalities at the Infrastructure and ensure a secure Infrastructure with documented procedures to manage emergencies. The prevention through design approach shall address occupational safety, security, ergonomics, industrial hygiene and emergency management needs in the design development process and set out a process to identify hazards, rate the risk of the hazard and carry out re-design work to prevent or minimize the risk posed by work-related hazards associated with the construction, manufacture, operations, use, maintenance and disposal of facilities, materials, equipment and processes.

C.5.3 Hazard Identification and Risk Assessment Requirements

C.5.3.1 Design Builder shall develop a Hazard Identification and Risk Assessment system (HIRA) to identify and rate all safety hazards at the Infrastructure.

C.5.3.2 Design Builder's HIRA shall include at a minimum the requirements and Submittals set out in this Section.

C.5.3.3 Steps in Hazard Identification and Risk Rating

C.5.3.3.1 In the HIRA, Design Builder shall develop an overall safety risk rating for each hazard identified at the Infrastructure. The HIRA shall include at a minimum an assessment of the probability that a hazard will occur and an assessment of the consequences of the hazard should it occur, that shall then be used to establish the safety risk rating. The process of establishing a safety risk rating is set out below.

C.5.3.3.2 Design Builder may propose alternative means of establishing a safety risk rating for each hazard for consideration by the City Representative provided it meets or surpasses the minimum standard as set out below and is consistent with Good Industry Practice and the requirements set out in the Technical Requirements. Design Builder shall submit any proposed alternative means of establishing a safety risk rating for review by the City Representative in accordance with the RFS procedure set out in Section A.5.2.

C.5.3.4 Probability Rating

C.5.3.4.1 Design Builder shall rate the probability that a hazard will occur using the scale found in Appendix 18F – O&M Information.

C.5.3.5 Consequence Rating

C.5.3.5.1 Design Builder shall rate the consequence of each hazard using the scale found in Appendix 18F – O&M Information.

C.5.3.6 Frequency Rating

C.5.3.6.1 Design Builder shall rate the frequency of each hazard using the scale found in Appendix 18F –O&M Information.

C.5.3.7 Risk Assessment Tool

C.5.3.7.1 Design Builder shall assess the safety risk rating of each hazard using Figure 2 from Appendix 18F – O&M Information.

(a) Use the following table as a means to establish the level of engineering and administrative controls and PPE that are typically required for each safety risk rating category:

Table 3: Hazard Controls and PPE

Safety Risk Rating	0 - 3 Low	4 - 10 Moderate	11 - 20 High	> 20 Very High
Engineering controls	None	None	• Use work equipment or other measures to prevent hazards • Install or use additional machinery/equipment	• Use mechanical equipment to isolate the hazards and separate the

Safety Risk Rating	0 - 3 Low	4 - 10 Moderate	11 - 20 High	> 20 Very High
			to control risk from physical or chemical agents	hazard from workers by methods such as enclosing or guarding dangerous items of machinery / equipment
Administrative controls	• Low level, such as site orientation	• Safe work procedures • Standard Operating Procedures • May require standardized training to perform task	• Safe work procedures • Standard Operating Procedures • May require specialized safety training	• Safe work procedures • Standard Operating Procedures • May require specialized safety training • Annual re-refresher training • Rescue team
PPE	• Basic	• Additional task specific machinery/equipment may be required	• Specialized safety equipment • Equipment may need to be fitted to worker • Training may be required for equipment • Equipment may need to be tested and/or re-certified • Physical fitness requirements for use of equipment	• Specialized safety equipment • Equipment to be fitted to worker • Training may be required for equipment • Equipment may need to be tested and/or re-certified • Physical fitness requirements for use of equipment

C.5.3.8 Acceptable Safety Risk Ratings

C.5.3.8.1 Design Builder shall use Good Industry Practice and the requirements as set out in this Schedule to eliminate or reduce risks, including by substituting less hazardous methods or materials, to ensure facilities, materials, equipment and processes at the Infrastructure meet the requirements for a safety risk rating of 10 or less, except:

(a) as noted otherwise in this DBA; or

(b) as otherwise set out in the Prevention Through Design Plan for which Design Builder has obtained a “Received” comment from the City under Schedule 5 – Review Procedure.

C.5.3.9 Upon reducing the safety risk ratings to 10 or less, except as noted in Section C.5.3.8 Design Builder shall include the risks in the O&M Information.

C.5.3.10 HIRA Requirements

C.5.3.10.1 As part of the 30% Design Submittal required under Appendix 18N – Design Submittal Requirements, Design Builder shall:

(a) identify in a tabular format the design requirements of Applicable Law related to safety that are applicable to the Infrastructure, using as an index the parts set out in WSHA and its associated regulations, and provide justification for those parts that in Design Builder’s opinion are not applicable to the Infrastructure;

(b) based on the 30% Design Submittal, identify the safety risk rating of all hazards at the Infrastructure that are reasonably inferable from the level of design development;

(c) for those hazards with a safety risk rating of 11 or higher, describe alternatives to re-design the Infrastructure to ensure a safety risk rating of 10 or less;

(d) engage a Certified Professional Ergonomist to carry out and provide the results of an ergonomics review by the ergonomics lead that includes ergonomic design principles and risk factors for musculoskeletal injury for occupational activities at the Infrastructure that pose a hazard including:

(i) a physical demands analysis of work activities;

(ii) an assessment of the layout and condition of the workplace or workstation;

(iii) consideration of the characteristics of objects handled;

(iv) characteristics of the organization of work;

(v) anthropometry/biomechanics (size, proportions, and mechanics of the human body):

(A) percentiles - height, weight, etc. (also consider the variation in individuals);

(B) maximum forces (e.g. Push, pull, grip); and

(C) reach envelopes (distances);

(vi) environmental conditions;

(i) controls/displays/communication, including:

(A) control response ratio; and

(B) location, colour, distances, etc.;

(ii) cognitive processing considerations, including:

(A) path of least resistance; and

(B) affordances and cultural stereotypes (e.g. Red means stop); and

(e) incorporate the results of the ergonomics review into the design for each area of the Infrastructure.

C.5.3.10.2 Host a facilitated workshop between Design Builder's HIRA Team and City Representatives to review the HIRA;

C.5.3.10.3 Provide an agenda, HIRA documentation and advance review material at least 14 Calendar Days in advance of the workshop;

C.5.3.10.4 Within 14 Calendar Days after the workshop provide minutes to the City Representative summarizing the main points of discussion, agreed upon actions and safe work procedures required for each area of the Infrastructure;

C.5.3.10.5 Ensure the report is signed by all members of Design Builder's HIRA Team.

C.5.3.10.6 As part of its 60% Design Submittal, 90% Design Submittal and the IFC Submittal, Design Builder shall:

(a) describe what design changes have been incorporated into its design since the last review workshop that materially impact the HIRA and demonstrate that the hazards identified in the previous Submittal have a safety risk rating of 10 or less;

(b) identify the safety risk rating of hazards at the Infrastructure that

are reasonably inferred from the level of design development and that were not identified in the previous Submittal. For each such hazard, provide the information required under Section C.5.3.3;

(c) carry-out activities set out in Section C.5.3;

(d) host a facilitated workshop between Design Builder's HIRA Team and the City Representative to review the HIRA in accordance with the timelines and requirements set out in Section C.5.4.2.

C.5.3.11 HIRA Workshop

C.5.3.11.1 At least 60 Calendar Days before applying for a Certificate of Substantial Completion, Design Builder shall host a 2-day facilitated workshop between Design Builder's HIRA Team and the City Representative to:

(a) carry out a walk-through review of the Infrastructure to ensure Design Builder has implemented and tested all recommendations from the HIRA workshops and to identify any actions required;

(b) confirm that all required documents, including training records, test results, Safe Work Procedures and Standard Operating Procedures have been submitted by Design Builder;

(c) within 5 Business Days after the workshop Design Builder shall provide the City Representative with minutes summarizing the main points of discussion and agreed upon actions. Within 45 Calendar Days after the workshop Design Builder shall submit to the City Representative for review in accordance with Schedule 5 – Review Procedure a report that documents the HIRA process signed by the HIRA Team and demonstrates that Design Builder meets the requirements of this DBA related to HIRA.

C.5.4 HAZOP Requirements

C.5.4.1 Design Builder's Responsibilities

C.5.4.1.1 Design Builder shall be responsible for carrying out a hazard and operability study (HAZOP) for the Infrastructure. All process and instrumentation diagrams shall be reviewed as part of the HAZOP workshop.

C.5.4.2 HAZOP Methodology

C.5.4.2.1 Design Builder shall:

(a) carry out the HAZOP workshop in accordance with *Guidelines for Hazard Evaluation Procedures* published by the American Institute of Chemical Engineers ("HAZOP Guidelines") and in accordance with the City's HAZOP Procedure included in Appendix 18D – City Standards. Use the City's HAZOP Procedure templates;

(i) Where terms such as “Consultant”, “Facilitator”, “Scribe” or “Engineer” are used within the City’s HAZOP Procedure included in Appendix 18D – City Standards, this indicates a Design Builder Party; and

(ii) Where term such as “Project Manager” is used within the City’s HAZOP Procedure included in Appendix 18D – City Standards, this indicates the City Representative;

(b) submit the HAZOP methodology with the 30% Design Submittal; and

(c) host a facilitated, multi-session workshop between Design Builder’s HAZOP Team and the City Representative to provide sufficient time to thoroughly review the HAZOP workshop not later than 60 Calendar Days after the following submissions:

(i) 30% Design Submittal; and

(ii) 90% Design Submittal.

C.5.4.3 Pre-HAZOP Workshop Requirements

C.5.4.3.1 Design Builder shall:

(a) conduct an internal HAZOP workshop with its HAZOP Team in advance and complete all changes or modifications of the process, flow, equipment and operation needed to meet the required level of hazard controls;

(b) complete P&IDs and PFDs to 99% (substantially complete and peer reviewed) in advance of a HAZOP workshop;

(c) submit to the City an agenda and supporting documentation for a HAZOP workshop, 14 Calendar Days prior to the HAZOP workshop. Supporting documentation shall include at minimum:

(i) P&IDs and PFDs for all nodes and areas being reviewed;

(A) the PFDs shall indicate high, low, and normal daily average flow rates for all process flow streams, and all key physical parameters such as pressure, temperature, pH, and atmospheric reactivity if applicable on all flow lines.

(d) nodes or areas being studied in a HAZOP workshop shall include all sub-systems or subsets of nodes which have probably modes of failure which may contribute to primary system failures. For example; the loss of the air conditioning system in an electrical room may contribute to overheating of a VFD, resulting in a process upset upon shutdown of the VFD;

(e) Prepare a summary narrative report describing in detail:

(i) levels of redundancy;

(ii) capacity; and

(iii) process flow parameters;

(f) pre-populate the HAZOP workshop software with all nodes, areas, and failure scenarios; and

(g) not use the HAZOP workshop for elaboration on design requirements, interpretation of the Technical Requirements, operational principles, or information gathering. Design input and reviews of P&IDs, and PFDs shall have been completed in advance of HAZOP workshops.

C.5.4.4 HAZOP Workshop Requirements

C.5.4.4.1 Design Builder shall:

(a) document HAZOP workshops using HAZOP software developed and intended for documentation and assessment of processing plants;

(b) have all lead process engineers provide a detailed narration of each node or area of the P&IDs at the onset of each section of the HAZOP workshop. Plans, 3D models, and process flow diagrams should be used to present the intended layout and operation of the facilities and controls; and

(c) include all existing facilities reused in the Infrastructure in its HAZOP workshop, accounting for existing equipment, operational parameters, and integration of existing process systems.

C.5.4.4.2 HAZOP workshop may be organized based on commonality of systems across various parts of the Infrastructure.

C.5.4.4.3 HAZOP workshop shall also include an Infrastructure wide review to assess overall external and internal process and services connections and shall consider events which can occur onsite and offsite.

C.5.4.4.4 All HAZOP workshops shall be conducted in a large meeting room with dual project screens. One screen shall be used for HAZOP software, and the second screen shall be used to display supporting documentation such as design information, P&IDs, PFDs, or 3D models.

C.5.4.5 Post-HAZOP Workshop Requirements

C.5.4.5.1 The Design Builder shall:

(a) within 14 Calendar Days after each workshop, provide minutes to the City Representative summarizing the main points of discussion and agreed upon actions;

(b) within 60 Calendar Days after each workshop, prepare a report for review by the City, in accordance with Schedule 5 – Review Procedure, setting out what changes will be incorporated into Design Builder's Design to ensure all hazards identified in the workshop will be addressed and mitigated, the subject matter and format of which report will be in accordance with the HAZOP Guidelines unless the parties expressly agree otherwise. The report shall also include:

(i) revised P&IDs identified by revision number, and also indicated on the drawings by "clouding" or colour coding; and

(ii) revised and updated process control narratives, as needed, to:

(A) identify direct interlocking between safety devices and process control devices;

(B) interlocks within the control system required to meet HAZOP requirements; and

(C) critical protection requirements within the system; and

(D) a list of outstanding items to be addressed by Design Builder that were not closed off completely during the HAZOP workshop and the disposition of each item, final disposition of the Design Builder on the item, and the impact on the design;

(c) within 30 Calendar Days of submitting each report, facilitate a 1-day close-out meeting with the City Representative to review the report;

(d) prepare an agenda for each close-out meeting;

(e) within 14 Calendar Days after the close-out meeting provide minutes to the City Representative of the main points of discussion and agreed upon actions; and

(f) conduct a layers of protection analysis (LOPA) on any systems, nodes, operations, or areas within the Infrastructure which have

been identified as having a potential to cause harm or death to an employee of the facility if any single failure may occur. The LOPA shall:

(i) be structured to suit the identified critical hazard or failure;

(ii) be arranged, coordinated, and facilitated by Design Builder;

(iii) have similar documentation requirements to the HAZOP report as set out in Section C.5.4.5.1 (b); and

(iv) initiate changes required to mitigate the hazard or failure which may result in harm or death to an employee of the facility.

C.5.5 Asset Criticality Requirements

C.5.5.1 Design Builder shall carry out Failure Mode and Effects Criticality Analysis on Assets in accordance with Appendix 18F – O & M Information.

C.5.5.2 Design Builder shall submit Phase 1 & 2 Asset Registry in accordance with Appendix 18H – Asset Registry.

C.5.5.3 Design Builder shall be responsible for documenting the Asset criticality for every Asset in the Infrastructure in accordance with Appendix 18H – Asset Registry.

C.5.5.4 Design Builder shall host a facilitated, multi-session workshop between Design Builder's Asset Criticality Team and the City Representative after submission of the complete 90% Design Submittal. Prior to the workshop, Design Builder shall:

(a) conduct an internal workshop with its Asset Criticality Team and complete all changes or modifications needed to meet the required level of hazard controls;

(b) prepopulate and submit a draft Asset Registry Template;

(c) submit an agenda for the asset criticality workshop; and

(d) complete P&IDs, PFDs, electrical single line diagrams and any other documents for use in the workshop.

C.5.6 Design Requirements

C.5.6.1 Design Builder shall ensure the design incorporates the findings and recommendations from all safety and hazard reviews as set out in this Section C.5 and demonstrate such requirements in its Design Submittals in accordance with Appendix 18N - Design Submittal Requirements.

C.5.6.2 Design Builder shall provide all safety equipment in accordance with Appendix 18E – Standardized Goods.

C.5.6.3 Confined Spaces

C.5.6.3.1 Design Builder shall:

(a) design and construct the Infrastructure so that no space within the Infrastructure is a confined space (as defined in the *Workplace Safety and Health Regulation* (Manitoba)), with the exception of the inside of chambers, wet wells, tanks, hoppers, bins, vessels, and conduits; and

(b) provide connections to the odour control system to accommodate supplemental ventilation that may be required for workers to enter spaces;

C.5.6.3.2 If Design Builder uses permanent or temporary staircases to eliminate confined spaces, ensure such staircases facilitate extraction and transport of an injured worker using a stretcher. The temporary staircases shall:

(a) be capable of being installed for use without entering the confined space, and where possible provide a standard stair case for use in multiple locations.

C.5.6.3.3 For doors and openings submerged when in service, Design Builder shall ensure the sills are flush with the floor and the doors allow unimpeded entry and exit.

C.5.6.4 Hazardous Atmospheres

C.5.6.4.1 Design Builder shall:

(a) provide continuous gas monitoring and alarms in all areas as identified in Section C.11.4 and in accordance with Appendix 18E – Standardized Goods;

(b) not use any asbestos containing materials;

(c) ensure that all plastic material installed at the Infrastructure meets or exceeds the requirements for toxic gas emissions as set out in Bombardier SMP 800-C Toxic Gas Generation; and

(d) upon request by the City, provide evidence and supporting documentation that all fibreglass reinforced plastic resin formulations meet or exceed the requirements for toxic gas emissions as set out in Bombardier SMP 800-C Toxic Gas Generation.

C.5.6.5 Emergency Shower and Eyewash

C.5.6.5.1 Design Builder shall:

(a) identify risks and hazards at the Infrastructure that require emergency showers and eyewash stations and locate emergency showers and eyewash stations accordingly;

(b) provide water flow switches to monitor the operation of each emergency shower and eye wash station, that when activated shall annunciate alarms to a local panel with horn and flashing light and shall be monitored by the PCS;

(c) ensure emergency showers and eyewash stations are highly visible from the location of the hazard and that the path from the hazard to the station is straight, level and unobstructed;

(d) not locate emergency showers and eyewash stations outdoors; and

(e) provide tempered water in accordance with the *Workplace Safety and Health Regulation* (Manitoba).

C.5.6.6 Lockout Devices

C.5.6.6.1 Design Builder shall:

(a) provide lockout devices on all electrical and mechanical equipment, equipment controls, valves and hydraulic control elements to protect workers from unexpected energization or start-up of machinery or equipment, or the unexpected release of an energy source, gas or liquid;

(b) provide equipment with designed lockout points, which lockout points must be suitable for use with the City's standard lockout devices; and

(c) provide all lockout and tag out documentation, in accordance with Appendix 18F – O&M Information.

C.5.6.7 Fall Protection

C.5.6.7.1 Design Builder shall:

(a) provide permanent fall protection anchors for personal fall/travel restraints or permanent floor inserts for installation of portable fall protection davits and window washing equipment;

(b) ensure temporary guardrail installations required during maintenance activities are supported by permanent floor inserts, that are flush with the floor and covered with removal panels to

eliminate tripping hazards;

(c) design the separation between permanent floor inserts to accommodate a standardized portable guardrail segment length;

(d) not use rope rail, chain, and temporary wooden guardrails on floors and platforms in the infrastructure,

(e) ensure guardrail systems do not trap water, ice, or snow if exposed to cold weather;

(f) ensure that sleeved inserts, if used, are flush with floor and covered with removable panels to eliminate tripping hazards;

(g) not use fall protection davits as hoists for equipment or other materials; and

(h) ensure all fall protection control measures include shop drawings certified by a Professional Engineer or qualified professional.

C.5.6.8 Electrical Safety

C.5.6.8.1 Design Builder shall provide:

(a) all electrical rooms with proper physical security means and warning signage describing the hazards in each room;

(b) safety warnings and informational signage adjacent to all power distribution equipment; and

(c) lockout and isolation devices on all power sources.

C.5.6.9 Safety Labels and Signage

C.5.6.9.1 Design Builder shall provide:

(a) safety warnings and informational signage for all areas of the Infrastructure where risk of personal injury or hazards exist and for the following minimum areas, hazards and equipment:

(i) area classifications;

(ii) confined spaces;

(iii) electrical hazards;

(iv) hazardous material locations;

(v) chemical storage labelling, including maximum chemical quantity stored on site and chemical hazards;

(vi) fire and explosion hazards;

(vii) requirements for PPE;

(viii) excessive noise levels, including decibel rating;

(ix) dangerous gases, foul air, or ventilation requirements;

(x) fall protection;

(xi) first aid room location and first aid equipment location;

(xii) mustering locations;

(xiii) fire extinguishers;

(xiv) emergency exits;

(xv) physical injury hazards;

(xvi) vehicular traffic hazards, including maintenance equipment; and

(xvii) pedestrian hazards;

(b) signage that identifies safe pedestrian routes to areas within the Infrastructure;

(c) luminescent directional arrows on floors and walls showing the direction to exits;

(d) site plan showing locations of all areas, hazards and equipment set out in this section. Design Builder shall post plastic laminated and framed signage in visible locations at all main entryways on all floors;

(e) include signage for emergency response plan;

(f) signage identifying safe routes from each area of the Infrastructure to an exit; and

(g) all safety signs and labels.

C.5.6.10 Ventilation Systems for Temporary Access

C.5.6.10.1 Design Builder shall provide:

(a) permanent or temporary ventilation systems, including portable ventilation equipment, for all tanks, channels, wet wells and other confined space or enclosed spaces to facilitate continuous ventilation while a worker is inside the space;

(b) temporary ventilation systems for each tank in accordance with the following:

(i) provide fixed tank connections at the deck level for a fresh air supply via portable ventilation unit and to exhaust air to the odour control system; and

(ii) introduce and exhaust air in a manner that shall eliminate dead spots and promote effective removal gases and vapours, whether heavier or lighter than air.

(c) permanent and temporary mechanical ventilation systems that comply with the more stringent of the following:

(i) maintain concentration of any airborne contaminants below the applicable exposure limits;

(ii) achieve an atmosphere with clean respirable air inside all tank areas within two hours of activating the continuous mechanical ventilation system when the tank, wet well, channel or enclosure or partial enclosure is completely drained; and

(iii) requirements of Applicable Law.

C.5.6.11 Process Fluids or Foul Air Isolation

C.5.6.11.1 Design Builder shall:

(a) ensure that any pipe, line, duct, or conduit containing a harmful substance connected to the confined space is designed to allow for disconnection or isolation using double block and bleed or block-blank-bleed, as required;

(b) ensure that engineered gates are used as the primary means of isolation of liquid in channels;

(c) ensure stop logs are only used for secondary isolation of fluids in channels solely for the purpose of maintenance activities for the primary isolation device; and

(d) provide isolation valves with a built-in lockout mechanism.

C.5.6.12 Equipment Hoisting

C.5.6.12.1 Design Builder shall:

(a) include lift devices in the HIRA; and

(b) designate safe work zones below each lift.

C.5.6.13 Spill Containment

C.5.6.13.1 Design Builder shall:

(a) provide floor slopes to a sump location with alarms for detection of a spill and high level alarms in each containment area with PCS monitoring; and

(b) provide inert barrier protection against spills of reactive material to floors, drains, containments and sumps, where reactive materials will be present.

C.5.7 Safety Documentation Requirements

C.5.7.1 Design Builder shall provide safety documentation to allow the City to safely assume full operational responsibilities of the Infrastructure at Substantial Completion. Design Builder shall provide safety documentation in accordance with Appendix 18F – O&M Information.

C.5.7.2 In addition to the foregoing, the safety documentation shall include:

(a) documents required by Applicable Law;

■ documents consistent with City Standards;

(c) documents consistent with Good Industry Practice; and

■ documents required by the Technical Requirements.

C.5.7.3 Demonstration of Compliance with Documentation Requirements of Governmental Authorities

C.5.7.4 In each of the manuals described in Appendix 18F – O&M Information, Design Builder shall provide a table setting out the documentation requirements of Governmental Authorities that are applicable to the Infrastructure, using as an index the parts set out in WSHA. The table shall identify the requirements of Governmental Authorities at a high level and cross-reference to the applicable safety documents, including templates, standards, forms, plans, practices, procedures and other related documents.

C.6 Architectural

C.6.1 Codes and Standards

C.6.1.1 Design Builder shall design the architectural character of the Infrastructure in accordance with the WSTP Architectural Design Guideline found in Appendix 18D – City Standards, including the codes and standards referenced therein, except the reference to "*and make a recommendation based upon the best lifecycle cost for the City*" in Section 4.3.6.

C.6.2 Space Requirements

C.6.2.1 Schedule of Areas and Room Data Sheets

C.6.2.1.1 Refer to Appendix 18J – Room Data Sheets.

C.6.2.2 Additional Requirements for Rooms

C.6.2.3 In addition to the room specific requirements outlined in the Appendix 18J – Room Data Sheets, Design Builder shall provide the following at the Infrastructure:

(a) 4 coat hooks in all habitable rooms; and

(i) coat hooks shall be large enough to accept winter coats and overalls and must be capable of carrying 10 kg;

■ roller blinds for all exterior windows in plant staff areas.

C.6.2.4 Design Builder shall comply with the WSTP Architectural Design Guideline for general requirements for doors and openings. Unique requirements are noted in Appendix 18J – Room Data Sheets.

C.6.2.5 Mechanical and electrical information is provided in Appendix 18J – Room Data Sheets for convenience. Refer to Section C.11 and Section C.12 for mechanical and electrical detail requirements.

C.6.2.6 Plant Staff Areas

C.6.2.6.1 Design Builder shall:

(a) provide and install rubber base for all spaces that have wall finishes other than concrete;

(b) provide vestibules at all connection locations between the plant staff areas and process building areas; and

(c) design and construct the areas in accordance with the *City of Winnipeg Accessibility Design Standards*. Where such areas are not located on a ground floor, provide elevator access.

C.6.2.6.2 Plant staff areas include:

(a) meeting room;

(b) Main Control Room; and

(c) boot room.

C.6.2.7 Process Buildings

C.6.2.7.1 Design Builder shall, for the process buildings:

(a) design according to WSTP Architectural Design Guideline;

(b) provide light colour epoxy paint on all walls;

(c) ensure proper sealing of all exposed concrete block;

(d) Provide wall mounted storage of removable handrails in all locations where removable handrails are provided around floor openings and tanks. Modular widths of handrail sections are to be standardized throughout the treatment building to allow for flexibility; and

(e) Provide storage space for ladders in locations where they will not interfere with circulation or daily operation and maintenance.

C.6.3 Image

C.6.3.1 Design Builder shall:

(a) provide Infrastructure that expresses site responsive design and is complementary to existing architectural character. Building imagery to provide the following characteristics:

(i) new buildings facing Main Street are to maintain consistent texture and materials similar to the other buildings facing onto Main Street;

(ii) other building faces shall reflect the faces of adjacent buildings to be generally consistent in finish, detail and scale;

(iii) conceived as a complete composition of scale, function, form and texture; and

(iv) ensure new building systems are responsive to the Existing Infrastructure for a campus-like setting;

■ design and construct Infrastructure with materials that are durable, long-lasting, low maintenance and of high quality finish that are suitable for an industrial facility.

C.6.4 Building Form and Scale

C.6.4.1 Design Builder shall provide Infrastructure with the following characteristics:

- [redacted] the elements of building height, site setback, proportion and spatial enclosure are compatible to the context, buildings and spaces in relation to site context; and

(b) uses massing and materials to achieve articulation, visual interest and human scale.

C.6.4.2 Exterior Building Materials

C.6.4.2.1 Design Builder shall utilize exterior materials that are approved by the WSTP Architectural Design Guideline and any of the following acceptable exterior materials:

(a) precast concrete panels;

(b) prefinished profiled metal cladding;

(c) composite aluminum prefinished panels;

(d) aluminum framed glazing walls; and

(e) architectural concrete masonry units.

C.6.4.2.2 Clay brick masonry applications are to be limited to highly visible public areas to reduce maintenance requirements.

C.6.5 Building Envelope

C.6.5.1 Design Builder shall:

- [redacted] construct the exterior walls of the Infrastructure in accordance with *WSTP Architectural Design Guideline* and with the best practices for minimum industry standard rain-screen principles;

- [redacted] ensure continuation of the air barrier, vapour barrier, thermal barrier and rain barrier across the entire envelope including foundations, walls and roofs;

(c) ensure that materials and systems of the wall and roof assemblies contribute to reducing heat gains and losses with minimal decline in performance over their expected lifespan. At minimum, buildings shall meet the Manitoba Energy Code for Buildings; and

(d) provide building envelope standard details as follows:

(i) incorporate clean and considered detailing at intersections where materials meet or change;

(ii) construct the building envelope details to eliminate thermal bridging;

(iii) integrate louvres and removable panels into the building envelope; and

(iv) ensure the building envelope does not infringe on any space above process tanks that would prevent the concrete deck level from being removed in its entirety in the future.

C.6.6 Building Rooftop

C.6.6.1 Design Builder shall design roofs according to the *WSTP Architectural Design Guideline*.

C.6.7 Process Buildings

C.6.7.1 Design Builder shall:

[redacted] provide exit stairs to accommodate occupancies at any location on the roof of the Infrastructure;

(b) provide roof access for maintenance purposes in accordance with the Technical Requirements; and

(c) construct all rooftops of cast-in-place or precast concrete.

C.6.8 Access and Entrances

C.6.8.1 Design Builder shall:

[redacted] provide plant staff access points to building interiors that are:

(i) covered or weather protected at main entrances; and

(ii) equipped with steps and ramps required for accessibility where required by the *City of Winnipeg Accessibility Design Standards*. https://winnipeg.ca/ppd/Universal_Design.stm;

(b) provide entrance vestibules configured and sized to preserve the airlock effect for climate control;

(c) ensure adequate distance between sets of doors to allow for accessibility;

[redacted] provide automatic doors at the public entrance(s) that are activated by accessible push-button controls located on the inside and outside of both sets of doors;

(e) configure automatic doors for push-pull manual operation in addition to automatic operation and card access, where required;

(f) RFI Card access is required at all grade entrances to buildings and interconnecting tunnels if external access to tunnel from adjacent building is possible, except for public entrances;

■ provide weather protection for all exterior stairs; and

(h) use aluminum or, cast-in-place concrete for exterior stairs at process buildings.

C.6.9 Transparency and Fenestration

C.6.9.1 Design Builder shall:

(a) provide glazing at appropriate areas on all building levels and all building sides to allow for the admittance of natural light into plant staff areas;

■ provide a fenestration door window ratio between 10 and 29 percent;

(c) provide sun shading for facing windows exposed to early morning or late evening sunlight to reduce glare and solar gain;

(d) provide operable windows in the plant staff areas both for ventilation and ease of cleaning, and where windows are not easily accessible, equip windows with motorized electronic closers and control points;

(e) provide window placement and size to accommodate all wall-mounted storage units, work counters and work surface heights; and

■ glazing shall be serviceable from floor level or scissor lift. Portable ladders are not permitted for window servicing.

C.6.10 Vehicular Flow

C.6.10.1 Design Builder shall:

■ limit vehicle corridors inside buildings to 5 km/hr and provide speed limit signs;

(b) provide traffic signage and painted lines on all roadways and corridors within the buildings where equipment will be transporting materials, equipment or supplies; and

■ provide blind spot mirrors where equipment or vehicles are turning around corners and at intersections with restricted view.

C.6.11 Signage

C.6.11.1 Design Builder shall provide all signage for the Infrastructure as follows:

(a) use consistent materials, colours, letter fonts, sizes and other aesthetic and functional considerations, to conform to the overall wayfinding design

system on all buildings;

- integrate all signage into the building design and complement the architectural expression;

(c) use international symbols where and as applicable; and

- use materials that are resistant to graffiti and physical damage.

C.6.12 Interior and Exterior Lighting Design

C.6.12.1 Design Builder shall:

(a) provide lighting in accordance with the WWD Electrical Design Guide;

- provide lighting for onsite roadways, walkways, and the parking area to provide safe vehicle and pedestrian movement;

(c) use lighting to highlight the Infrastructure and dramatic industrial features where appropriate; and

(d) provide site lighting in the colour temperature range of 3,000 to 5,000 Kelvin and that is composed of highly efficient lighting fixtures complementary to the overall site and architectural design concept.

C.6.13 Acoustics and Noise Control

C.6.13.1 Design Builder shall follow the WSTP Architectural Design Guideline and apply the following principles:

(a) provide room shapes, workstation configurations and sound absorptive materials and finishes appropriate to the interior acoustic and reverberation requirements for the intended use of the room or space;

- provide the required degree of sound insulation between the exterior and interior, as well as between interior spaces within the Infrastructure through space planning and building material;

- provide finishes that dampen footfall and building services and equipment vibration so that, along with other measures taken by Design Builder, the function of vibration-sensitive equipment uses and spaces are not disturbed by the effect;

(d) provide control of building services noise through space planning to address the adjacency/proximity of mechanical and electrical spaces to minimize their effect on noise sensitive areas;

- provide wall, roof, and floor assemblies with acoustic performance in accordance with the minimum requirements described in the Technical Requirements;

(f) provide buffer zones (e.g. corridors) between noise sensitive areas (e.g. meeting rooms and offices) and noisy areas (e.g. process areas);

(g) avoid vertical adjacencies between noisy and noise sensitive areas;

(h) design and construct interior assemblies to the STC rating criteria stipulated in WSTP Architectural Design Guideline;

(i) engage a professional acoustic engineering consultant throughout the design, construction and commissioning;

(j) provide an acoustic report outlining acoustic requirements of the Technical Requirements and methods of achieving these;

(k) construct the Infrastructure to mitigate the acoustic impact of the adjacent CPR rail tracks;

(l) design and construct the Infrastructure to address acoustics when organizing the buildings, grouping programs with intense activity and equipment away from plant staff offices;

(m) construct the Infrastructure so that internal noise generating rooms and activities or exterior building systems and equipment are acoustically shielded from interior and exterior spaces that require low noise levels;

(n) isolate mechanical systems appropriately from solid-borne and airborne noises to all interior spaces;

(o) construct the Infrastructure so that large velocity air circulation vents are not located in proximity to, and do not interfere with, quiet environments;

(p) provide room finishes that absorb sound for all occupied spaces throughout the Infrastructure; and

(q) where ear protection is required, provide signage and disposable hearing protection for the area.

C.6.13.2 Acoustic Treatment and Noise Isolation Requirements

C.6.13.2.1 Design Builder shall:

(a) provide acoustic treatment and sound attenuation per the *WSTP Architectural Design Guideline*;

(b) provide acoustic treatment where sound attenuation or other sound control measures are necessary to create a safe and comfortable environment or where speech privacy is required, including:

(i) attenuation of sound within plant staff and public environments;

(ii) sound isolation between the exterior and interior spaces;

(iii) sound isolation between interior spaces within the building at both horizontal and vertical separations; and

(iv) sound and vibration isolation of building service noises and sound isolation of building service rooms.

(c) isolate structure-borne vibrations and sound with resilient mountings on vibrating equipment to minimize sound transfer to structural materials;

(d) provide ducts, pipes, and conduits with resilient, non-rigid boots or flexible couplings where they leave vibrating equipment and isolate from the structure with resilient gaskets and sealant where they pass through walls, floors, or other building surfaces;

(e) use acoustic screens, vibration isolators, and carefully selected exterior equipment to prevent exterior noise that neighbours may find offensive;

(f) provide wall and floor assemblies with STC ratings in accordance with Table 4.;

(g) extend the STC rated assembly full-height from floor to the underside of structure above for all walls and partitions requiring an STC rating in Table 4.;

(h) address details such as the ceiling plenum conditions, windows, doors, penetrations through the construction to optimize field performance sound isolation ratings;

(i) provide demountable partitions with a minimum STC rating of 45;

(j) provide moveable partitions with an STC rating of 45 minimum;

(k) for testing, use the ASTC test method as outlined in the applicable ASTM standard; achieve test results within 5 points of the stated STC requirement for acceptability; use NIC measurement parameters only where rooms being tested are too small to meet the ASTM requirements for room size;

(l) provide sound isolation to ensure privacy and minimize intrusive noise from exterior sources;

(m) comply with the STC ratings for specific rooms provided in Appendix 18J –Room Data Sheets or, if none is provided in the appendix, with the guideline for general room types provided in Table 4and following sections:

Table 4: Recommended Minimum STC Ratings for General Room Types*

Room Type	Recommended STC
Offices and admin (non-critical)	45
Washrooms/change rooms	45
Kitchen	45
Control room	50
Meeting rooms/multi-purpose (non-critical)	50
Offices, meeting rooms/multi-purpose (high privacy)	55
Server room	55
Process area corridors	60
Mechanical / electrical	60

* STC ratings in Table 4. are considered the laboratory STC ratings unless otherwise noted. Table 6 will provide normal speech privacy (except at corridor walls with doors), assuming a background sound level of at least 30 dBA.

(n) apply STC ratings to the perimeter of the room and also through ceiling and floor constructions and assemblies;

(o) where adjacent rooms have different STC ratings, apply the higher rating to the demising partition, floor or ceiling;

(p) strategically locate noise sensitive rooms such that they are not adjacent to rooms that generate high noise levels;

(q) provide sound isolating partitions having an STC rating of 45, or greater;

(r) seal all perimeter joints tightly;

(s) partitions containing windows and/or doors may not meet the STC requirements of Table 4as they will be limited by the STC of the applicable windows and doors specified. In this case, use a composite STC 35 rating to include all components for rooms designated to be STC 55 or higher;

(t) provide all doors in sound isolating partitions including office, training rooms, meeting rooms and multipurpose rooms, as dense core wood doors having a minimum face weight of 20 kg/m²;

(u) provide all doors in sound isolating partitions with ratings of STC 55 and higher with fully grouted or mortared metal frames;

(v) seal airtight penetrations of sound isolating partitions to maintain specified STC ratings; and

(w) layout ductwork to minimize penetrations through sound isolating partitions.

C.6.13.3 Background Noise – Interior Spaces

C.6.13.3.1 Design Builder shall, in undertaking the design of the Infrastructure:

(a) follow the WSTP Architectural Design Guideline found in Appendix 18D – City Standards;

(b) evaluate the expected noise from all mechanical systems and equipment in the Infrastructure;

(c) design and construct the Infrastructure so that noise from the mechanical systems and equipment does not exceed the noise level specified in Table 5 in the dBA column, within the room or space identified:

Table 5: Noise Criteria – Rating Within Various Spaces

Room Type	NC	dBA
Offices/multi-purpose room	35	50
Meeting rooms	35	50
Control rooms	35	50
Washrooms/change rooms	45	55
Process area corridors	45	55

(d) provide HVAC equipment to meet the NC requirement for the spaces specified in Table 5;

(e) locate silencers as close as possible to the air handling units (before the ducts exit the mechanical room);

(f) not locate ducts with air velocities greater than 5 m/s in the ceiling space of spaces that have an NC rating less than NC-40;

(g) provide duct elbows and branches that are radiused;

(h) select room air diffusers to have an NC rating that is five points quieter than the NC rating for the room for rooms rated at NC 30-35 and ten points quieter than the NC rating for rooms rated at NC25-30;

(i) provide noise isolating supports to support ducts and plumbing to the building structure; and

(j) provide proper vibration isolation for transformers.

C.6.14 Vibration Control

C.6.14.1 Design Builder shall:

(a) properly isolate vibrating equipment from the building structure;

(b) select vibration isolators to provide minimum 95 percent vibration isolation;

(c) provide flexible connectors for duct and pipe connections to vibrating equipment unless the ductwork or piping is properly vibration isolated;

■ provide vibration isolation to meet the requirements for any vibration sensitive equipment, including laboratory equipment; and

(e) limit vibration levels (maximum root means square level in each 1/3rd octave band in the frequency range of 4 Hz to 80 Hz) in the Infrastructure, from vibration sources that are internal to the infrastructure, or external to the Infrastructure or project site to:

(i) multipurpose rooms – 0.05 mm/s;

(ii) plant staff areas – 0.2 mm/s; and

(iii) process buildings – 0.8 mm/s.

C.6.15 Noise Control – Exterior

C.6.15.1 Design Builder shall limit interior noise levels (15 minute Leq) due to exterior sources to not exceed the *WSTP Architectural Design Guideline* or the specified room dBA in Table 5.

C.6.16 Inventory

C.6.16.1 Design Builder shall perform an analysis of the noise levels in each room expected to have noise levels in excess of 75 dBA at the upgraded Infrastructure to determine the noise level and provide recommendations on required hearing protection;

C.6.16.2 The inventory shall be completed in accordance with the *WSTP Architectural Design Guideline*.

C.7 Geotechnical and Hydrogeological

C.7.1 Codes and Standards

C.7.1.1 Design Builder shall perform all aspects of the geotechnical investigation and design in accordance with the latest edition of the Canadian Foundation Engineering Manual and all other codes, standards, and City Standards specified in this Section C.7.

C.7.2 Investigations

C.7.2.1 The City previously performed geotechnical investigations at the NEWPCC. The data from these investigations are included in Appendix 18S – Geotechnical Investigations and may be relied upon by Design Builder in carrying out its design, subject to the conditions in Appendix 18S – Geotechnical Investigations.

C.7.2.2 Notwithstanding Section C.7.2.1, Design Builder shall, without limiting any other provision of this DBA, carry out all geotechnical and hydrogeological investigations, analyses, assessments, determinations, testing and development of inputs necessary to perform design and construction in accordance with the DBA.

C.7.2.3 If Design Builder requires additional investigation, Design Builder shall provide a Subsurface Investigation Plan as set out in C.3.4.

C.7.3 Geotechnical Resistance Factors

C.7.3.1 Design Builder shall use the geotechnical resistance factors specified in the current National Building Code in the design of raft and deep foundations for the Infrastructure.

C.7.4 Geotechnical and Hydrogeological Design Report(s)

C.7.4.1 Design Builder shall follow the Canadian Foundation Engineering Manual for the general format of all geotechnical reports, and shall follow most recent ASTM standards on Design, Planning, and Reporting of Groundwater and Vadose Zone Investigation. Design Builder shall ensure that such reports include the information listed in this Section, as applicable.

C.7.4.2 Design Builder shall prepare geotechnical and hydrogeological design report(s) in support of the Design of the Infrastructure in accordance with this Section and submit such reports to the City Representative for review in accordance with Schedule 5 – Review Procedure. Submit such reports not later than 90 Calendar Days after subsurface investigations are complete. Design Builder shall, at a minimum, include the following in the geotechnical and hydrogeological design reports:

(a) an executive summary;

(b) a description of the purpose and the scope of the report;

(c) a description of the investigations carried out including the methodology and equipment used;

(d) a description of site conditions, geology, inferred subsurface stratigraphy and groundwater levels;

(e) plans, sections, and profiles showing surveyed test locations and inferred stratigraphy and groundwater levels;

(f) a summary of the engineering properties of the strata;

(g) all results and factual data collected;

(h) an outline of design codes, criteria, parameters and philosophies applied in the report;

(i) interpretation of factual data and summary of inferred subsurface conditions, and geotechnical and hydrogeological design parameters at each major component of the geotechnical and hydrogeological designs;

(j) a description of the methods used to determine geotechnical and hydrogeological engineering properties of soils, including assumptions and references to standards;

(k) methodologies, references and descriptions of all computer models and software used;

(l) discussion of the geotechnical and hydrogeological designs and construction issues, and the geotechnical and hydrogeological approaches to developing the project site and the Infrastructure to meet performance requirements;

(m) results of all geotechnical and hydrogeological analyses and recommendations in support of the design and the construction. At a minimum, include the recommended geotechnical and hydrogeological instrumentation program, including instrumentation details and monitoring frequency to confirm performance of the geotechnical and hydrogeological design during construction and the Warranty Period;

(n) method of excavation, shoring, dewatering, etc. that will be implemented based on results of the geotechnical and hydrogeological analyses;

(o) description of the proposed groundwater discharge location;

(p) an estimate of the amount, rate, and duration of groundwater discharge being proposed;

(q) the foundation design for each component of the infrastructure to be constructed by Design Builder, including at a minimum:

(i) foundation type;

(ii) vertical and lateral load capacity;

(iii) bearing capacity, in ultimate limit state and serviceability limit state, of raft and deep foundations;

(iv) pile installation recommendations, including equipment and drivability assessment;

(v) settlement predictions both during the Warranty Period and through the service life of the foundation elements as set out in Table 2 of this Schedule;

(vi) evaluation of elastic rebound and time dependent swelling due to removal of overburden or change in moisture;

(vii) evaluation of total and differential settlement within and along structures, and between piled and grade-supported facilities, and between piping, conduits, channels and structures;

(viii) mitigation measures, where required, to ensure satisfactory performance throughout the service life of the foundation elements as set out in Table 2 of this Schedule; and

(ix) any requirements for retaining walls and below-grade walls including lateral earth pressures under static loads, backfill materials, design groundwater head and drainage requirements with design of drainage system to withstand the groundwater flow rate;

(r) quality assurance testing of all geotechnical and hydrogeological aspects of the design, such as static and dynamic pile testing, and for quality assurance testing of any other ground support systems that will be carried out during design and construction;

(s) the geotechnical and hydrogeological design of retaining structures, as per the limit state design, including stability, sliding, lateral deformation, bearing capacity, settlements during construction, and, during the service life of the foundation elements as set out in Table 2 of this Schedule, consideration of long-term total and differential settlements and methods to mitigate any such settlements;

(t) subsurface and site drainage requirements;

(u) design and installation of any underground facilities;

(v) specifications for all fill material composition, compaction, placement and testing method;

(w) geotechnical and hydrogeological recommendations for construction, including temporary excavation, shoring and dewatering design, subgrade preparation, staged fill placement and stages of removal of shoring lateral supports;

(x) design recommendations on excavation, shoring and dewatering, including at a minimum:

(i) methodology, extent and depth; and

(ii) identification of potential challenges, concerns or difficulties expected by Design Builder with its chosen methodology, and recommendations for overcoming these.

(y) design recommendations for trenchless pipe installations, as required, with associated evaluation for surface and subsurface settlement, ground loss, face stability, stickiness and clogging potential;

(z) comments and recommendations on effects of temporary excavation, shoring and dewatering, foundation construction, pile installation and other construction activities on existing conditions within the Zone of Influence of the dewatering area including at a minimum:

(i) estimated vibrations and zone of influence due to pile installation and other construction activities and vibration monitoring requirements including frequency of monitoring, threshold values and action plan in case of exceeding the threshold values;

(ii) estimated settlement, subsidence, displacement and deformation expected from excavation, shoring, removal of lateral supports and dewatering activities;

(iii) identification of potential challenges, concerns or difficulties expected by Design Builder with its chosen methodologies, and recommendations for overcoming these; and

(iv) assurance that estimated settlement, subsidence, displacement and deformation will be within the tolerances set out in this DBA and as otherwise required by Applicable Law.

(aa) recommendations for any additional geotechnical investigation, testing, or analysis required to address any insufficiency in the information and data regarding the Lands and the Infrastructure;

(bb) methods that will be used to incorporate all recommendations into the design; and

(cc) design data showing the proposed geotechnical and hydrogeological designs.

C.7.4.3 For clarity, all recommendations provided in the geotechnical and hydrogeological design report(s) shall be implemented by Design Builder in its Final Design and construction methods.

C.7.4.4 All geotechnical and hydrogeological reports shall be signed and sealed by the geotechnical Professional of Record and hydrogeological lead, respectively, and by other qualified professionals included in directing and carrying out the work.

C.7.4.5 Upon submission of the As-Built Submittal and of the records documentation, the design calculations must be made available if required by the City Representative. Design Builder shall keep a copy of all current calculations that shall be initialed by both the geotechnical Professional of Record and hydrogeological lead.

C.7.4.6 Design Builder shall update the geotechnical and hydrogeological design report(s) prepared and shall submit the updated geotechnical and hydrogeological design report(s) with the As-Built Submittal.

C.7.5 Foundation Design

C.7.5.1 Design Builder shall complete the design and construction of the foundations for the Infrastructure in accordance with the requirements and criteria set out in this Section C.9 to ensure that:

(a) all foundations have the necessary capacity to support the design loads and meet the performance requirements of this DBA including:

(i) the total and differential settlements of the foundations are compatible with the function and performance requirements of the Infrastructure over the service life of each of the components of the Infrastructure as set out in Table 2; and

(ii) the foundations and their construction do not adversely impact any Existing Conditions and structures.

C.7.5.2 Demonstrate, through comprehensive geotechnical and structural analyses and designs, that the tolerances set out in this Schedule 18 will continue to be met over the service life of the Infrastructure.

C.7.5.3 In the design reports, the geotechnical Professional of Record and hydrogeological lead shall provide certification that they have reviewed the geotechnical engineering aspects of all foundation elements, and civil engineering aspects of design to ensure that they are consistent with applicable design requirements, in accordance with the Manitoba Building Code and the current National Building Code of Canada, Volume 1 (Div B).

C.7.5.4 Design Builder shall provide the following:

- sufficiently detailed field and laboratory investigations to characterize the subsurface conditions; and

(b) analyses and modeling of deformations under static and live loading conditions anticipated over the service life of the infrastructure.

C.7.5.5 For greater certainty, the results of the analyses required by the geotechnical and hydrogeological design report, in no way limit Design Builder's obligations under this DBA, and Design Builder shall remain responsible for satisfying the overall performance objectives of the Infrastructure over the service life of the Infrastructure, as set out in this DBA.

C.7.6 Pile Foundation Design and Testing Requirements

C.7.6.1 Design Builder shall:

- carry out the design of deep foundations in accordance with Manitoba Building Code and the National Building Code of Canada (Div B);

- design all pile foundations, to resist all static, dynamic and seismic structural and kinematic loads applied to the piles throughout the service

life of the Infrastructure, such that the settlement and displacement tolerances set out in this DBA are met;

(c) design and specify all piling methodology and equipment necessary to install the piles to the design tip elevation, accounting for:

(i) the design structural requirements of the foundation;

(ii) the soil and groundwater conditions underlying the project site; and

(iii) all logistical and sequencing constraints that are part of the project site and construction activities;

(d) for driven piles, carry out comprehensive analysis to determine driveability requirements necessary to specify pile set and acceptance criteria for all driven piles. The drivability analyses shall consist of the wave equation analysis of pile driving and shall be carried out and certified by the Professional of Record. Such detailed analyses shall be carried for all proposed driven pile types and hammers;

(e) notwithstanding the generality of the foregoing, ensure that all piles, caissons, or other deep foundation systems are tested in accordance with accepted techniques and procedures commonly used for such systems consistent with Good Industry Practice, and ensure that they meet the minimum required axial resistance and the requirements of this DBA;

(f) test all piles, caissons, or other deep foundation systems in accordance with this Section;

(g) perform pile monitoring during cast-in-place pile installation. At a minimum, cast-in-place pile monitoring shall include:

(i) confirmation of soils strength;

(ii) confirmation of the competency of the rock quality by visual inspection of the retrieved rock cores. Rock cores shall be retrieved using a core barrel;

(iii) confirmation of the competency of the rock quality at the base by advancing a small diameter proof drilling to 2 m below the socket or other similar means;

(iv) applying measures to maintain socket wall stability and groundwater control;

(v) confirmation that the socket is in acceptable conditions by using remote television inspection with video link to the surface or any other similar inspection means while maintain socket wall stability;

(vi) confirmation of the cleanliness of drilled hole. Ensure 50 percent

of the shaft base has less than 12.5 mm of sediment and that no part of the shaft base has more than 37.5 mm of sediment;

(vii) pile length, socket length and embedment;

(viii) pile diameter;

(ix) pile reinforcement characteristics;

(x) concrete testing; and

(xi) pile plumbness;

(h) perform pile monitoring during driven pile installation. At a minimum, driven pile monitoring shall include:

(i) pile length;

(ii) pile diameter or dimension;

(iii) pile driving energy;

(iv) refusal criteria;

(v) embedment depth;

(vi) pile plumbness; and

(vii) splicing details (where applicable);

(i) retain a qualified testing agency to carry out Pile Driving Analyzer (PDA) on driven piles, subject to the following:

(i) perform dynamic testing in accordance with this Section, including dynamic monitoring during pile installation and subsequent data analysis using the CAPWAP software program;

(ii) testing of driven piles shall comprise instrumented dynamic testing utilizing PDA equipment and tested in accordance with ASTM D4945 Standard Test Method for High-Strain Dynamic Testing of Deep Foundation. Testing of piles or other types of deep foundation systems shall be carried out in accordance with accepted techniques and procedures commonly used for such systems in the industry;

(iii) a minimum of 5 percent of driven piles shall be tested using dynamic methods to confirm that the minimum required capacities have been achieved such that:

(A) 50 percent of testing occurs within the first 25 percent of pile installation;

(B) 75 percent of testing occurs within the first 50 percent of pile installation; and

(C) 100 percent of testing occurs by completion of pile installation;

(D) all works associated with dynamic monitoring shall be defined as end of initial drive or beginning of restrike;

(E) the PDA testing results must be made available to the City within a 24-hour period for upon request including:

(F) pile information including identification, section details and grade;

(G) driving methodology and equipment details;

(H) pile penetration sets;

(I) PDA testing equipment and procedures;

(J) delivered energy;

(K) CAPWAP analysis will be completed for each pile tested at end of initial drive and beginning of restrike;

(L) CAPWAP summary results including peak compression and tension forces, peak stresses. PDA testing results including mobilized resistance for shaft and toe, embedment length, penetration resistance, test condition;

(M) dynamic measurements data in a table with graphics form of wave traces showing force and velocity;

(N) conclusions and recommendations for estimated mobilized axial resistances for piles tested;

(O) comments and details on any structural damage to piles; and

(P) a summary report of the PDA results shall be submitted to the City, in accordance with Schedule 13 – Document Management System, within 20 Business Days of completing the PDA testing;

(j) retain a qualified testing agency to carry out static load tests for pile types not compatible with dynamic testing;

(i) such testing agency shall submit a summary report of the test results to the City, in accordance with Schedule 13 – Document Management System, within 20 Business Days of completing the

static load testing;

(k) conduct quality control of concrete work as per CSA A23.1-14. At a minimum, concrete quality control shall include:

(i) sampling of concrete for testing purposes;

(ii) slump flow testing;

(iii) air content determination; and

(iv) compressive strength tests;

(l) ensure that all piles are approved by the Professional of Record, subject to the following:

(i) pile acceptance shall be determined based on the measured capacities at beginning of restrike;

(ii) damaged piles are to be rejected;

(iii) any work completed on the foundation elements (pile caps, cut-off, welding, etc.) before pile acceptance by the Professional of Record shall be at Design Builder's own risk.

C.7.7 Raft Foundation Design Requirements

C.7.7.1 Design Builder shall:

(a) design all raft foundations in accordance with the current Manitoba Building Code and current NBCC, Volume 1;

(b) design all raft foundations, accounting for the soil and groundwater conditions underlying the Lands, and in accordance with this Section, to resist all static, dynamic and structural loads applied to the foundations throughout the service life of the Infrastructure, such that the settlement tolerances set out in this DBA are met;

■ analyze all raft foundation settlements, including:

(i) immediate elastic total and differential settlement;

(ii) total and differential settlement due to consolidation in soils;

(iii) total and differential settlement due to long term creep of soils under foundation loads; and

(iv) creep settlements for the service life of the structure; and

(d) not support slabs on soil without adequate granular base.

C.7.8 Excavation, Shoring and Dewatering

C.7.8.1 Design Builder shall provide an Excavation, Shoring and Dewatering Plan as set out in Section C.3.5.

C.7.8.2 Excavation, Shoring and Dewatering Design and Construction

C.7.8.2.1 Design Builder shall:

(a) obtain all necessary permits, encroachment rights, access rights, and permission to design and construct shoring, excavation and dewatering elements prior to beginning excavations, shoring, or dewatering activities;

(b) write all reports required by Governmental Authorities and submit such reports to the Governmental Authorities on behalf of the City along with a copy to the City;

(c) ensure that the excavation, shoring and dewatering do not cause settlement, displacement or deformation of, damage to, or negative impact on structures, services, drainage systems, or other features within, or beyond the Zone of Influence;

(d) ensure that the design and construction of each of the excavation, shoring and dewatering systems are compatible and coordinated with each other and include allowance for supporting and unplanned excavation;

(e) prepare shoring and excavation designs that result in stable excavations with an adequate penetration depth of shoring, an adequate factor of safety against the potential risk of piping, upheaval, overall shear failure modes including basal heave and push in and shoring systems that are capable of supporting all loads imposed on them, including those of soil, groundwater, structures, or vibrations;

(f) consider interference of the selection of a dewatering system with construction operations, available space, sequence of construction operations and duration of dewatering; and

(g) remove all equipment, materials, and supplies from the site, immediately upon completion of the dewatering system, and remove all surplus materials and debris, fill in all holes or excavations, and grade the site to elevations of the surface levels that existed before work started. The site shall be thoroughly cleaned and acceptable to the City Representative.

C.8 Civil

C.8.1 Codes and Standards

C.8.1.1 Design Builder shall design the Infrastructure in accordance with the *WSTP Civil Design Guideline* including the codes, standards and City standards referenced therein, as well as any additional code and standard referenced in this Section C.8.

C.8.2 Site Infrastructure

C.8.2.1 Design Builder shall:

(a) provide gutters, sidewalks, walkways, pavement markings, and traffic calming devices that are handicapped accessible and wheel-chair friendly, to provide safe passage between parking areas (including off-site parking areas), loading areas, emergency vehicle areas and drop off areas, in accordance with the *City of Winnipeg Accessibility Design Standards*;

(b) locate all services underground; additional poles and overhead connections are not permitted;

(c) provide buried utilities with sufficient protective cover to ensure frost protection and prevent damage from loaded vehicles; and

(d) site and screen all services including transformers, kiosks, storage and garbage/recycling areas.

C.8.2.2 Design Builder shall provide all infrastructure required by any Governmental Authority as part of any Permit for the Project, whether located on or off the Lands.

C.8.2.3 Perimeter Fencing

C.8.2.3.1 Design Builder shall:

(a) provide a minimum 2.4-metre-high enclosure system, where required to keep the Infrastructure secure and inaccessible to the public, measured from the highest adjacent grade; and

(b) provide fencing systems as part of the architectural concept and designed to inhibit graffiti and be integrated with the design of security gates at entry and exit points.

C.8.2.3.2 Design Builder shall refer to the *WSTP Civil Design Guideline* for fencing requirements.

(a) fencing shall incorporate the headworks facility so as to reduce the amount of fencing viewable from Main Street.

C.8.3 Roadways and Parking Areas

C.8.3.1 Design Builder shall:

(a) complete a roadway condition assessment of all existing roadways within the Lands before any construction taking place including photographs and ensure that all roadways will be in a condition equal to or better than the pre-construction condition at Final Completion;

(b) arrange the Infrastructure and the Works for efficient and safe access into and throughout the Lands and the Infrastructure;

(c) not interrupt existing City Operations;

(d) demolish existing roadways where required by breaking down and removing the existing pavement and all related base/subbase materials and placing suitable fill material to fill the void, followed by topsoil and sod. Final grading shall be completed so there will be no ponding of water and positive drainage is maintained to the nearest drainage appurtenance, or drainage ditch;

(e) pave all final permanent roadways within the perimeter of the Construction Lands;

(f) utilize Portland concrete pavement at all loading/unloading areas/loading docks/containment areas of sufficient size so that the pad dimensions extend 1.0 m longitudinally beyond the longest vehicle dimension and 0.5 m laterally beyond the vehicle width, for the largest vehicle anticipated to be accommodated at each particular loading/unloading/containment area.

(g) utilize Portland cement concrete pavement where in slab heating is required and increase the concrete slab thickness by 100 mm to accommodate any in slab heating lines and reinforcing, if required; and

(h) provide concrete paved walkways for routine foot traffic including pathways from parking areas and roadways to entry doors and to exterior equipment and structure that require routine or emergency access.

C.8.3.2 Design Builder shall design the roadways and parking areas for the following:

(a) roadway widths;

(b) general alignment;

(c) turning radii, for design vehicles;

(d) building access for design vehicles;

(e) grade;

(f) vertical curvature;

(g) cross sloping;

(h) in slab heating, where required;

(i) curbs

(j) horizontal curvature;

(k) clearances;

(l) sidewalks;

(m) walkways;

(n) parking areas; and

(o) pavement.

C.8.4 Design Vehicles

C.8.4.1 Design Builder shall ensure that roadways, loading bays, filling stations, operations and maintenance areas and other facilities interfacing with or within the Infrastructure can accommodate the design vehicles as set out in the *WSTP Civil Design Guideline*. Design Builder shall also ensure access for other vehicles including:

(a) all emergency vehicles, including City of Winnipeg Fire Department largest ladder truck;

(b) cranes and other vehicles required to remove any equipment from the Infrastructure for maintenance or at the end of its service life including return activated sludge and waste activated sludge pumps and secondary clarifier scraper mechanisms; and

(c) City contractors and haulers.

C.8.5 Land Drainage Management

C.8.5.1 Design Builder shall provide a Land Drainage Management Plan as set out in Section C.3.6.

C.8.5.2 Design Builder shall design the land drainage management for the following:

(a) site grading;

(b) ditches and open channels;

(c) culverts;

(d) land drainage sewers;

(e) manholes and catch basins;

(f) retention and detention storage ponds; and

(g) oil and sediment interceptors.

C.8.5.3 Land Drainage Criteria

(a) Design Builder shall:

(i) design the minor land drainage systems, consisting of the gravity sewer pipeline network, plus gutter and inlets that provide a conveyance system to carry storm runoff from road surface for the City of Winnipeg's 5-Year MacLaren rainfall event;

(ii) design major land drainage systems, consisting of open ditch, swales, and culverts for the City of Winnipeg's 25-Year MacLaren rainfall event;

(iii) design retention/detention facilities to accommodate runoff from the City of Winnipeg's 100-Year MacLaren rainfall event. The calculated storage volume shall be verified based on the City of Winnipeg extreme rainfall event in May 2010.

(iv) determine the peak runoff from the subcatchment SC-3, as indicated in Schedule 12 – Lands, Site(s) and Facility(ies):

(A) if the rational method is used to estimate the peak runoff, Design Builder shall use, as a minimum, the runoff coefficients in the *WSTP Civil Design Guideline*; and

(B) if hydraulic modeling software is used, the hydrologic infiltration parameters, such as Horton infiltration, shall be confirmed with the City's requirements.

(v) direct discharge to the John Black drainage system at a maximum allowable discharge of 0.19 m^3/s.

(vi) provide retention/detention facilities for subcatchment SC-3, as indicated in Schedule 12 – Lands, Site(s) and Facility(ies), on Site North East. Design Builder shall provide the retention/detention facilities according to the following:

(A) system shall either be below ground storage, a surface detention pond, or a combination thereof. Surface retention ponds are not acceptable;

(B) system may be combined with storage on roadways and parking lots. Roof top storage is not acceptable;

(C) underground storage structures shall either be underneath

parking lots or the landscaping over top shall be sodded;

(D) surface detention ponds shall be landscaped in an aesthetically pleasing manner to fit in with nearby parkland and the future Chief Peguis Trail Greenway multi-use path corridor incorporating bank stabilization and plantings that are capable of withstanding at least 7 days of submergence below water;

(E) provide a backflow prevention device to prevent backflow from the John Black drainage system into the detention pond; and

(F) land drainage storage systems on Site North East shall not be visible from Main Street;

(vii) as a minimum, use the design rainfall coefficients in the *WSTP Civil Design Guideline*; and

(viii) prepare hydraulic grade line calculations using:

(A) a spring flood water level of approximately 227.4 metres at the John Black land drainage system and the City of Winnipeg's 10 Year McLaren rainfall event; and

(B) a summer water level of approximately 224.8 metres at the John Black land drainage system and the 100 Year and May 2010 rainfall events.

C.8.5.4 Minimum Depth of Cover

C.8.5.4.1 Design Builder shall provide a minimum depth of cover for all land drainage sewers as follows:

(a) land drainage sewers;

(i) 1.2 metres in travelled areas;

(ii) 1.0 metres in non-travelled areas; and

(b) 0.60 metres for culverts under roadways and driveways:

C.8.5.5 Minimum Pipe Diameter

C.8.5.5.1 Design Builder shall provide minimum pipe diameters for land drainage system, as shown in Table 6:

Table 6: Stormwater Minimum Pipe Diameters

Description	Minimum Pipe Diameter (mm)
Storm sewers	250
Culverts under roadways	450
Culverts under driveways	300
Catch basin leads	200

C.8.5.6 Minimum Velocity and Grade

C.8.5.6.1 The land drainage sewer pipeline shall be sized to provide a minimum flushing velocity of 0.9 m/s based on a pipe roughness coefficient of 0.013. The minimum grade for ditch and open channel design shall be 0.5 percent.

C.8.6 Water Distribution

C.8.6.1 Design Builder shall:

(a) in the design report summarize the detailed calculations for water distribution system design to meet the City's requirements;

(b) provide a detailed water distribution system design for the Construction Lands with all specifications and associated drawings;

(c) provide a looped water distribution system from Main Street;

(d) conduct a water age analysis to confirm the quality of water is maintained throughout the NEWPCC water distribution system;

(e) provide a hydraulic analysis to meet the design criteria as set out in the City's Water Demand and Design Guidelines;

(f) provide backflow preventers on any connections to the City water distribution system, including water main and feeder main;

(g) design the water distribution system for the following:

(i) minimum depth of cover;

(ii) pipe structural design;

(iii) fire hydrants;

(iv) valves;

(v) pipe material;

(vi) dissimilar materials and corrosion protection;

(vii) thrust restraint; and

(viii) abandonment of existing water mains;

(h) provide all other necessary data and information for the completion of the fire protection study as described in Schedule 18 Appendix 18K – Special Studies and Modules; and

(i) provide a branch, terminated with a blind flange, along the north boundary of the NEWPCC site that extends to the west side of the high purity oxygen reactors for future connection to the water distribution system.

C.8.6.2 Design Criteria

C.8.6.2.1 Design Builder shall provide a potable water system based on the following minimum criteria:

(a) domestic water demand calculation as set in the *WSTP Civil Design Guideline*. Design Builder shall verify the maximum water demand with the Governmental Authority prior to design of the potable water system;

(b) the fire protection flow for each building at the NEWPCC shall be determined based on the guidelines set by the Fire Underwriters Survey. Available fire flow shall be stated at 140 kPa (20 psi) residual during the Maximum Day demand;

(c) use the following Hazen-Williams C factor for hydraulic analysis:

(i) C = 120 for new water mains with diameters less than or equal to 200 millimetre;

(ii) C = 130 for new water mains with diameters greater than 200 millimetre; and

(iii) appropriate C values for existing water mains based on pipe material, age and diameter.

(d) provide minimum water main pressure under peak hour demand conditions of 207 kPa (30 psi);

(e) provide minimum feeder main pressure under peak hour demand conditions of 310 kPa (45 psi);

(f) provide backflow preventers for each connection to the municipal water system;

(g) provide back flow preventers for all connections to the existing water distribution system;

(h) provide a looped system for the proposed water distribution system; and

(i) provide fire hydrants to cover the Construction Lands based on the fire analysis completed by Design Builder.

C.8.6.3 Separation

C.8.6.3.1 Design Builder shall provide a minimum horizontal separation from all sanitary sewers, process fluid sewers, forcemains, and land drainage sewers of 3.0 metres and a minimum vertical separation of 0.45 metre.

C.8.6.4 Minimum Pipe Diameter

C.8.6.4.1 Design Builder shall provide minimum pipe diameters for the water system as shown in Table 7;

Table 7: Minimum Pipe Diameter for Water System

Type	Minimum Diameter (mm)
Mains	150
Service Connections	To meet Infrastructure requirements

C.8.6.5 Fire Hydrants

C.8.6.5.1 Design Builder shall provide fire hydrants within 45 metres of each building entrance.

C.8.6.6 Connection to Building

C.8.6.6.1 Design Builder shall design piping connections to buildings and rigid structures to prevent shear and settlement using appropriate means including flexible ball joints, grade beams, and non-shrink foundation materials.

C.8.6.7 Installation of Water Mains

C.8.6.7.1 Installation of water main shall be in accordance with *the WSTP Civil Design Guideline* found in Appendix 18D – City Standards and the Standard Construction Specifications.

C.8.7 Wastewater Sewers

C.8.7.1 Design Builder shall:

(a) provide new sewer mains to service new structures (where service is required); and

(b) follow the WSTP Civil Design Guideline.

C.8.7.2 Design Builder shall design the wastewater sewers in accordance with the *WSTP Civil Design Guideline* including its requirements for the following:

(a) depth of cover;

(b) wastewater sewer main materials;

(c) wastewater sewer size; and

(d) manholes.

C.8.7.3 Design Criteria

C.8.7.3.1 Design Builder shall provide a wastewater sewer collection system design based on the following criteria:

(a) wastewater design flow rate shall include peak domestic inflows, extraneous inflow and infiltration, processing wastewater flows, and wash down flows;

(b) gravity wastewater lines shall be designed to attain minimum flushing velocity of 0.6 m/s under full flow conditions using a roughness co-efficient (n) of 0.013;

(c) the Harmon peaking factor shall be used to calculate the peak dry weather wastewater flow; and

(d) extraneous flow contributions shall be as below:

(i) ground water infiltration: 2,200 L/ha/d

(ii) manhole infiltration: 2 L/min/manhole

C.8.7.4 Installation of Sewer Mains

C.8.7.4.1 Installation of sewer lines shall be in accordance with *the WSTP Civil Design Guideline* found in Appendix 18D – City Standards and the Standard Construction Specifications.

C.8.7.5 Connection to Existing Sewer Mains

C.8.7.5.1 Connection to existing sewer system shall be in accordance with Appendix 18B – Specifications.

C.8.7.6 Abandonment of Existing Sewer Mains

C.8.7.6.1 Abandonment of existing sewer mains shall be in accordance with Appendix 18B – Specifications.

C.8.7.7 CCTV Inspection

C.8.7.7.1 Perform and submit, within 30 Calendar Days of installation, video inspection, including inspection report, of new or modified sewers in accordance with Appendix 18B – Specifications.

(a) if video inspection indicates repairs are required, Design Builder shall make repairs and perform re-inspection of the pipe section. Resubmit video inspection and inspection report within 30 Calendar Days of the repair.

C.8.8 Buried Major Yard Piping, Interceptor Sewers and Process Piping

C.8.8.1 Design Builder shall;

(a) design and construct all buried process and yard piping;

(b) design and construct all raw wastewater lines from the existing sewer interceptor pipes to the proposed headworks to convey flow at startup, design flows (Year 2037), and future peak wet weather flows, as set out in Table 1;

(c) design and construct all staging of piping to accommodate all flows that may be prevalent at time of construction; and

(d) design and construct all chambers, manholes, junctions, and valve chambers.

C.8.8.2 Design Criteria

C.8.8.2.1 All piping shall be designed at a minimum to the requirements outlined in the *WSTP Civil Design Guideline*.

C.8.8.3 Hydraulic Design Criteria

C.8.8.3.1 Design, construction and staging of works shall not result in detrimental increases in interceptor trunk hydraulic grade line that would result in increased basement flooding or sewer overflows to the environment.

C.8.8.3.2 Design Builder shall avoid, to the extent possible, constructing structures over existing or new interceptors and wastewater sewers. Where unavoidable, pre-construction and post-construction video inspection and inspection reports shall be undertaken to demonstrate that the buried infrastructure has not been damaged. If damaged, Design Builder shall repair and re-inspect and submit inspection video and inspection report.

C.8.8.3.3 Hydraulic design velocities and minimum roughness coefficients shall be as per the *WSTP Civil Design Guideline*.

C.8.9 Design Life

C.8.9.1 All piping and components shall have a service life of 100 years.

C.8.10 Pipe Structural Design

C.8.10.1 Design pipes, at a minimum, to the *WSTP Civil Design Guideline*;

C.8.10.2 When working in close proximity or connection to existing pipelines, designs shall consider the original pipe design parameters and construction methods, and ensure the existing pipes and structures are not negatively impacted;

C.8.10.3 Consider effects of asymmetrical loading on existing pipes because existing monolithic sewer pipes can be sensitive to changes in external loads; and

C.8.10.4 Differential settlement at buildings and structures shall be considered. Settlement at trench crossings shall be considered.

C.8.11 Trenchless Pipe Design

C.8.11.1 Trenchless pipe installations shall be designed and constructed using *ASCE 36 Standard Design and Construction Guidelines* for Microtunneling or other approved industry best practices for the proposed installation method.

C.8.11.2 Concrete pipes used for jacking shall be designed using ASCE 27 Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction.

C.8.11.3 Pipe joints used for trenchless installation shall be suitable for construction and jacking loads. Provide proof of design testing on request.

C.8.12 Pipe Joint Design

C.8.12.1 Forcemains and pipes that are normally surcharged in operation shall be designed with pressure pipe joints.

C.8.12.2 Metallic portions of pipe joints forming integral part of joint integrity shall be constructed of corrosion resistant materials, coated with approved dielectric coatings and linings and/or provided with cathodic protection to support pipe design life requirements.

C.8.13 Excavations, Shoring and Shaft Design

C.8.13.1 Conform to Section C.7.8.

C.8.13.2 Design shafts, shoring and excavation to prevent detrimental movements to existing pipes, structures and buildings.

C.8.13.3 Stage excavations, shoring and shaft construction to consider use and maintenance of Existing Infrastructure and services.

C.8.13.4 All shafts, shorings and excavations shall be designed with input by an experienced geotechnical engineer registered in the Province of Manitoba.

C.8.13.5 All shafts, shoring and excavations requiring dewatering shall be designed with input from an experienced hydrogeological engineer registered in the Province of Manitoba. Dewatering effects of adjacent facilities, structures and aquifer users shall be considered.

C.8.13.6 Consider use of sealed shaft construction techniques, where appropriate.

C.8.14 Interceptor Flow Control Structures

C.8.14.1 The City will implement real time flow management in the future. The real time flow management schemes have not been fully developed at this time. Real time flow management structures will be used to provide a means of regulating flows and to utilize any available upstream storage independently in each interceptor trunk. Real time flow control schemes are not defined and development of flow regulation is not required as part of Design Builder's work. However, Design Builder shall allow for a space approximately 20 metres by 20 meters along each of the interceptor sewers for future installation of the flow control structures. No above ground structures or utilities shall be constructed in these spaces. Indicate these spaces on relevant site plans.

C.8.14.2 Design Builder shall include consideration for a future Northwest Interceptor trunk in its design. The future Northwest Interceptor trunk will run north of and parallel to the existing Northwest Interceptor. Design Builder shall provide an 1800 mm diameter stub with blind flange in the interceptor junction chamber for the future interceptor.

C.8.15 Valves, Gates, Flow Control and Actuation Design

C.8.15.1 For other below grade valves, gates, and flow control devices, Design Builder shall comply with the following requirements;

[redacted] unless otherwise permitted by the City, flow control devices and valves shall be installed in galleries or surface accessible structures to permit maintenance;

(b) structures housing flow control devices shall be designed with consideration for future access and maintenance without disruption to operations; and

(c) structures housing flow control devices shall support confined space entry, and shall provide a minimum of 2 points of surface access. Access for removal and maintenance of equipment shall be provided.

C.8.16 Natural Gas

C.8.16.1 Design Builder shall:

(a) size the gas systems based on the building and process requirements of

the Infrastructure;

- provide online pressure measurement of each natural gas feed to the Infrastructure, with signal to the PCS; and

(c) design the gas system in accordance with the CSA B149.1 Natural Gas and Propane Installation Code, the requirements of Section C.11.5, and the Building Mechanical Design Guideline.

C.8.16.2 Design Builder shall locate gas piping a minimum of 300 millimetres horizontally from all other underground piping and allow a minimum of 50 millimetres clearance at crossings with other piping.

C.8.16.3 Design Builder shall ensure the minimum depth of cover for the gas service is 460 mm.

C.8.17 Corrosion Protection

C.8.17.1 Provide corrosion protection for all buried and exposed piping and services. Refer to Section C.10.8.5 of this Schedule for corrosion protection system requirements.

C.8.18 Landscaping

C.8.18.1 Design Builder shall landscape the Construction Lands before Final Completion in accordance with *WSTP Civil Design Guideline*.

C.8.18.2 Design Builder shall use trees along Parcel A facing Main Street that are suitable for the climate and require minimal watering.

C.8.18.3 Design Builder shall provide a minimum of 20 trees and shall collaborate with the City in developing its landscape design.

C.8.18.4 Design Builder shall use the *City of Winnipeg Tree Planting Details and Specifications* as a guide for selection and placement of trees.

C.9 Structural

C.9.1 Codes and Standards

C.9.1.1 Buildings, Structures, and Liquid Holding Structures

C.9.1.1.1 The structural systems shall be designed in accordance with the current editions of the following codes and standards:

(a) buildings and non-process structures

(i) City of Winnipeg, *WSTP Structural Design Guideline*s, included in Appendix 18D – City Standards; and

(ii) CSA S478, Guideline on Durability in Buildings.

(b) Concrete liquid holding tanks and process structures

(i) *WSTP Structural Design Guideline*; and

(ii) Canadian Standards Association (CSA)

(A) CSA S6, Canadian Highway Bridge Design Code; and

(B) CSA S37, Antennas, Towers, and Antenna-supporting Structures.

(c) American Concrete Association (ACI):

(i) ACI 350.3, Seismic Design of Liquid-Containing Concrete Structures and Commentary; and

(ii) ACI 372R Guide to Design and Construction of Circular Wire-and-Strand-Wrapped Prestressed Concrete Structures.

(d) American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):

(i) ASCE 7, Minimum Design Loads for Buildings and Other Structures.

(e) American Water Works Association (AWWA):

(i) AWWA D110, Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks; and

(ii) AWWA D115, Tendon-Prestressed Concrete Water Tanks.

(f) Design guides including:

(i) all design guidelines and reference material in *WSTP Structural Design Guideline*.

C.9.1.2 Concrete Structures (Buildings and Non-Process Structures)

C.9.1.2.1 The following codes and standards shall be used for concrete structures design:

(a) all codes, design guidelines, and reference material in *WSTP Structural Design Guideline*.

C.9.1.3 Foundations

C.9.1.3.1 The following codes and standards shall be used for foundation design:

(a) all codes, design guidelines, and reference material in *WSTP*

Structural Design Guideline.

C.9.1.3.2 Refer to Section C.7 of this Schedule for a discussion on geotechnical requirements.

C.9.1.4 Steel Structures

C.9.1.4.1 The following codes and standards shall be used for steel structures design:

(a) all codes, design guidelines, and reference material in *WSTP Structural Design Guideline*; and

(b) the Steel Construction Institute, Design Manual for Structural Stainless Steel.

C.9.1.5 Masonry Structures

C.9.1.5.1 The following codes and standards shall be used for masonry structures design:

(a) all codes, design guidelines, and reference material in *WSTP Structural Design Guideline*; and

(b) CSA A165 Series, CSA Standards on Concrete Masonry Units

C.9.1.6 Aluminum Structures

C.9.1.6.1 The following codes and standards shall be used for aluminum structures design:

(a) all codes, design guidelines, and reference material in *WSTP Structural Design Guideline*.

C.9.1.7 Fibre Reinforced Structures

C.9.1.7.1 The following codes and standards shall be used for fibre reinforced structures design:

(a) CSA S806, Design and Construction of Building Structures with Fibre-Reinforced Polymers; and

(b) CSA S6, Canadian Highway Bridge Design Code.

C.9.1.8 Timber Structures

C.9.1.8.1 The following codes and standards shall be used for timber structures design:

(a) CSA O86, Engineering Design in Wood.

C.9.1.9 Lifting Devices

C.9.1.9.1 The following codes and standards shall be used for lifting devices design:

(a) CSA B167, Overhead Cranes, Gantry Cranes, Monorails, Hoists, and Jib Cranes.

C.9.2 Investigations

C.9.2.1 Design Builder shall, without limiting any other provision of this DBA, carry out all structural investigations, analyses, assessments, determinations, testing and development of inputs necessary to perform design and construction in accordance with the DBA.

C.9.2.2 Design Criteria

C.9.2.3 Buildings, tanks, liquid-retaining structures and structures shall be designed to meet or exceed the requirements of the current design standards referenced in the *WSTP Structural Design Guideline* and to the codes and standards listed in Section C.9.1.

C.9.2.4 Buildings that house essential services or processes required to treat wastewater post-disaster shall be designed, at minimum, to be operational after the post-disaster event, in accordance with the NBCC. Design features such as structure lateral load-resisting systems, structures with irregularities, and storey or level lateral stiffness shall conform to the NBCC.

C.9.2.5 Foundation design, details, pressures at founding level (ultimate and serviceability stress states), frost penetration depth, design groundwater level, lateral earth pressure coefficients shall be based on recommendations made by Design Builder's geotechnical engineer.

C.9.2.6 Foundation structural systems for liquid retaining structures shall be designed to limit settlement to 10 millimetres and differential settlement to 10 millimetres. Foundation elements shall be designed for a service life as per Table 2. Acceptable foundation for liquid retaining structures shall be precast prestressed concrete pile, steel pipe piles, and steel HP piles. Acceptable foundations for other structures shall be precast prestressed concrete pile, cast-in-place concrete piles, steel pipe piles, and steel HP piles.

C.9.2.7 Service platforms shall be metal and corrosion resistant based on the environment in which they are installed.

C.9.2.8 The buildings and structures shall be designed for a minimum service life as per the Table 2. The governing document for structural engineering water retaining structures is ACI 350. In addition, the following methods shall be incorporated to extend the service life of these structures:

- [redacted] concrete mix design including:

(i) shrinkage control;

(ii) use of cementitious materials (fly ash, slag, silica fume, and others);

(iii) use of admixtures for durability to extend service life;

(iv) control total water in the concrete; and

(v) use of a self-healing permeability-reducing admixture for hydrostatic conditions as per ACI 212.3R-10 for all concrete tank walls.

- concrete exposure classes based on CSA A23.1 requirements shall be minimum A-1 (in contact with wastewater) and S-1 (in contact with wastewater and soil) for hydraulic structures. Design of the structure to limit cracking of the concrete from shrinkage and applied loadings;

(c) additional concrete clear cover on reinforcement;

(d) use of controlled permeability formwork liner (e.g. Zemdrain);

- proper curing and construction practices; and

- provision of protection from all potential attacks on concrete including:

(i) selection of concrete mix designs and finishes to prevent leaching of lime from the cement;

(ii) protection of concrete from sulphates in the soil;

(iii) protection of concrete from acids with liners or coating systems;

(iv) protection of concrete from erosion due to fast moving water or grit in water;

(v) protection of concrete from chlorides; and

(vi) protection of concrete from mechanical abrasion.

C.9.3 Design Loads

C.9.3.1 Structural elements shall be designed to carry all superimposed loads, including dead loads, live loads, environmental (snow, rain, ice, and wind) loads, seismic loads, earth pressure, flooding and fluid loads, thermal loads, crane and monorail loads, and operational loadings. In addition, where the effects of differential settlement, creep, shrinkage, or temperature change are significant, these loadings shall be included in the design.

C.9.3.2 Load combinations for buildings and hydraulic structures shall be as specified in *WSTP Structural Design Guideline*.

C.9.3.3 Dead Loads

C.9.3.3.1 Minimum dead loads shall be as specified in *WSTP Structural Design Guideline*.

C.9.3.4 Live Loads

C.9.3.4.1 Minimum live loads shall be as specified in *WSTP Structural Design Guideline* and live load reduction shall not be used.

C.9.3.5 Liquid Loadings

C.9.3.5.1 Liquid loads shall be defined and applied per *WSTP Structural Design Guideline*;

C.9.3.5.2 Uplift loads from groundwater shall be accounted for as per *WSTP Structural Design Guideline* and may also be counteracted by connection to the piles based on the recommendations of Design Builder's geotechnical engineer; and

C.9.3.5.3 Liquid loadings shall be as specified in *WSTP Structural Design Guideline* and the referenced standard ACI 350.

C.9.3.6 Earth Pressure Loads

C.9.3.6.1 Allowable soil bearing pressures and backfill and groundwater loadings on walls shall be in accordance with recommendations of Design Builder's geotechnical engineer.

C.9.3.7 Wind Loadings

C.9.3.7.1 All buildings, structures, stacks, piping, and equipment that are exposed to wind forces shall be designed to meet the requirements of the NBCC and *WSTP Structural Design Guideline*s.

C.9.3.8 Snow, Rain, and Ice Loadings

C.9.3.8.1 All building and structure roofs exposed to snow and rain shall be designed to meet the requirements of the NBCC and *WSTP Structural Design Guideline*s.

C.9.3.9 Seismic Loadings

C.9.3.9.1 Seismic loadings shall be based on NBCC and seismic parameters as provided by Design Builder's geotechnical engineer.

C.9.3.10 Special Loadings

C.9.3.10.1 Thermal loads shall be considered for structural members permanently or partially exposed to exterior conditions and for interior structural members subject to thermal loads and rapid temperature changes. The design

temperature range shall be in accordance with that specified in *WSTP Structural Design Guideline*.

C.9.3.10.2 The following special loadings shall be determined per ACI 350.4 and the NBCC as follows:

(a) impact loads;

(b) loads at pipe penetrations;

(c) forces at gates;

(d) internal pressure and vacuum; and

(e) vibration conditions.

C.9.3.10.3 Crane loads, at minimum, shall be the capacities required for service plus braking and impact loads.

C.9.3.10.4 Worker safety loads such as for guardrails and fall arrest shall be in accordance with WSHA and its associated regulations.

C.9.3.10.5 Concrete mixes, placing procedures, reinforcing, and control joints shall be designed to limit shrinkage and thermal stresses and crack widths to produce water tight structures with extended Service Life.

C.9.3.10.6 Blast loads shall be considered where appropriate as per *WSTP Structural Design Guideline*.

C.9.4 Hydraulic and Pneumatic Tightness Testing

C.9.4.1 All concrete hydraulic structures shall be tested to the requirements of ACI 350.1. Each tank shall be tested independently with adjacent tanks empty. Testing shall be conducted before installation of backfilling or application of coatings.

C.9.5 Deflection Limit Criteria

C.9.5.1 Deflection limits shall meet the criteria defined in *WSTP Structural Design Guideline.*

C.9.5.2 Concrete structures shall meet the requirements of CSA A23.3 and ACI 350M for deflections, but not less than the requirements of *WSTP Structural Design Guideline*.

C.9.6 Vibration Design Criteria

C.9.6.1 Design for vibration from equipment shall be to the requirements of *WSTP Structural Design Guideline*. Equipment manufacturers shall be consulted for information such as frequencies, unbalanced loads, use of vibration isolators or dampeners, and support requirements.

C.9.7 Material Guidelines

C.9.7.1 Design Builder shall refer to *WSTP Structural Design Guideline* for the requirements of materials to be used in the various structural systems.

C.9.7.2 Design Builder shall ensure that all materials used are compatible with the specific environments within the buildings or process areas, including consideration for all chemicals used or produced, to achieve the required design service life of the facility or component as set out in Table 2.

C.9.8 Liners for Concrete Structures

C.9.8.1 Liners shall meet the requirements specified in *WSTP Structural Design Guideline*.

C.9.8.2 As much as possible, concrete technology shall be used to achieve durability and functional requirements for wastewater exposures and cast-in-place liners shall be used only when special circumstances dictate in cases such as when chemicals incompatible with concrete are in contact with concrete. Design Builder shall demonstrate that the cast-in-place liners will protect the concrete and be maintenance-free for at least 30 years.

C.9.8.3 Concrete shall be protected from corrosion in harsh environments by the following:

(a) concrete mix designs shall be based on CSA A23.1-14, exposure class S-1 (if concrete is in contact with earth) or A-1, low-shrinkage concrete with shrinkage limit of 0.04 percent at 28 days (for testing with 75 millimetres x 75 millimetres prisms);

(b) use of permeability-reducing admixture for hydrostatic conditions in concrete mixes for exterior walls and slabs of sewage retaining structures;

(c) provision of a minimum clear cover for reinforcement of 60 millimetres as per CSA A23.1, instead of the 50 millimetres recommended by ACI 350-06;

(d) increase of minimum reinforcement for temperature and shrinkage from ACI 350-06 minimum to the amount required to limit shrinkage cracking width to 0.25 millimetres (Kianoush et al., 2006);

■ use of controlled permeable formwork liners (e.g. Zemdrain) on concrete formed surfaces exposed to sewage and liquids containing chlorides and/or salts to enhance the durability of the concrete surfaces;

(f) development and implementation of a temperature management plan for all mass concrete (as defined by CSA A23.1) placement and major wall placement of sewage retaining structures;

■ wetting of cure concrete to CSA A23.1; and

(h) lining of chemical storage areas with chemical resistant liners.

C.9.9 Lifting Devices

C.9.9.1 Impact loading and deflection limits shall meet requirements in NBCC and *WSTP Structural Design Guideline.* Lifting devices shall be designed for the environment being served, e.g. wet or dry service, and for frequency of use.

C.9.10 Reuse of Existing Structures and Buildings

C.9.10.1 Where existing structures and buildings are to be reused or connected to new construction, the structural implications shall be identified and assessed. Required structural modifications shall be incorporated into the structural design.

C.10 Process Mechanical

C.10.1 Codes and Standards

C.10.1.1 The process mechanical design shall be carried out in accordance with Appendix 18U – Process Mechanical Design Guide, including the codes, standards, and City Standards referenced therein and all other codes and standards referenced in this Section C.10.

C.10.2 Objective

C.10.2.1 The process mechanical design requirements apply to the design to enable the process mechanical aspects of the Infrastructure processes to function as intended, including the design requirements for: process tanks, process equipment, hydraulic and pneumatic conveyance, corrosion control, and odour control.

C.10.2.2 The requirements of building mechanical items, including plumbing and HVAC systems, are described in Section C.11.

C.10.2.3 The design requirements presented herein are intended to be general and minimum requirements that apply to the extent that they are not otherwise addressed in the process functions design requirements in Appendix 18A – Process Functional Requirements.

C.10.2.4 Piping identification requirements can be found in Appendix 18U – Process Mechanical Design Guide and the *Identification Standard* found in Appendix 18D – City Standards.

C.10.3 Submittal Requirements

C.10.3.1 Calculations

C.10.3.1.1 Design Builder shall prepare calculations as appropriate to support and demonstrate Design Builder's Design. The calculation documents shall be made available to the City upon request and shall be presented in a coherent manner including all methods used, reference material lists and

design assumptions.

C.10.4 Equipment Layout

C.10.4.1 Design Builder shall follow Appendix 18U – Process Mechanical Design Guide for layout of process equipment.

C.10.5 Process Tank Design Requirements

C.10.5.1 For process tanks including standpipes, Design Builder shall:

[redacted] size each tank for the governing design condition;

(b) size overflows capable of diverting the maximum fluid flow from the tank;

(c) ensure gravity tank drain lines are a minimum diameter of 150 millimetres or the ability to drain a tank in 24 hours, whichever is greater;

(d) provide drains with valves and flushing water connections;

(e) provide flushing water service with capacity for flushing and filling any process tank within 8 hours, except large volume tanks (greater than 5,000 m^3), which shall be filled within 5 days;

(f) provide isolation valves at each piped connection except for overflows. Where backflow of fluid or hazardous gas through an overflow can occur, provide spectacle or blind flanges for isolation of the overflow;

(g) provide a means to bypass all tanks and standpipes; and

[redacted] provide a means to ventilate the air space and convey foul air to an odour control system.

C.10.6 Hydraulic and Pneumatic Conveyance Design Requirements

C.10.6.1 Piped Conveyance

C.10.6.1.1 For process liquids, flushing water and slurries Design Builder shall:

(a) design all pressure pipes to flow full;

(b) size pipes to meet upstream and downstream head requirements under maximum design flow conditions and to meet minimum and maximum acceptable velocities;

(c) for pump and gravity pipe sizing calculations, explicitly list the equation(s) used (ie Hazen-Williams, Manning) and justify each equation's applicability to systems and commodities subject to the calculations - water, sewage, slurries, emulsions etc.

(d) use coefficients appropriate to the pipe material and condition (i.e.

new vs end-of-service-life). For example, use Hazen-Williams C of 140 (or commodity/equation-specific equivalent) for minimum head conditions in new smooth pipes, and Hazen-Williams C of 100 to 110 (or commodity/equation-specific equivalent) for maximum head conditions in older pipes. For conduits with inherently rougher or smoother surfaces or susceptible to more or less corrosion, scaling, etc., adjust factors accordingly.

(e) include itemized headlosses for all bends, reducers, increasers, valves, meters, tees, and entrance and exit losses and other system losses. Equivalent length estimates will not be permitted;

(f) limit line pressures to 690 kPa or the pressure rating of the pipe, whichever is lower;

(g) design piping to avoid vacuum conditions;

(h) provide air release mechanisms at all high points to facilitate air release and full hydraulic flow. Terminate air release exhaust vents a maximum of 300 millimetres above a trench perimeter drain; and

(i) design underground systems in accordance with CSA C22.3 No.7-M86.

C.10.6.2 Solids Piped Conveyance

C.10.6.2.1 For wastewater scum, grit conveyance and sludge containing solids of 2 percent or more, Design Builder shall:

(a) design all pressure pipes to flow full;

(b) size pipes to meet upstream and downstream head requirements under maximum design flow conditions and to meet minimum and maximum acceptable velocities;

(c) provide process sludge piping systems with a minimum pipe size of 150 millimetres diameter;

(d) provide grit piping systems with a minimum pipe size of 150 millimetres diameter or a smaller diameter permissible pipe if required to provide a minimum velocity of 1.5 m/s;

(e) convey liquids containing solids by pumping, not by gravity;

(f) calculate headlosses for liquids containing solids taking into account the full range of flow, percent solids, and pipe friction factors, for each system to account for all conditions when sizing pumps and piping systems;

(g) for pump and pipe sizing calculations, explicitly list the equation(s)

used (ie Hazen-Williams, Manning) and justify each equation's applicability to systems and commodities subject to the calculations - water, sewage, slurries, emulsions etc.

(h) use coefficients appropriate to the pipe material and condition (ie new vs end-of-service-life). For example, use Hazen-Williams C of 140 (or commodity/equation-specific equivalent) for minimum head conditions in new smooth pipes, and Hazen-Williams C of 100 to 110 (or commodity/equation-specific equivalent) for maximum head conditions in older pipes. Explicitly list any friction multipliers used and their relationship to the commodity's solids content and flow velocity. For conduits with inherently rougher or smoother surfaces or susceptible to more or less corrosion, scaling, etc., adjust factors accordingly.

(i) include itemized headlosses for all bends, reducers, increasers, valves, meters, tees, and entrance and exit losses and other system losses. Equivalent length estimates will not be permitted;

(j) limit line pressures to 690 kPa or the pressure rating of the pipe whichever is lower;

(k) design piping to prevent vacuum conditions; and

(l) provide air release mechanisms at all high points to facilitate air release and full hydraulic flow. Terminate air release exhaust vents a maximum of 300 millimeters above a trench perimeter drain.

C.10.6.3 Open Channel Conveyance

C.10.6.3.1 For channels conveying process fluid, Design Builder shall:

(a) complete the hydraulic design using conventional first principles hydraulic calculations and CFD to confirm flow splitting over the range of hydraulic conditions;

(b) design channels with a Manning “n” roughness coefficient for worst case condition (e.g. age-related concrete deterioration) expected;

(c) design channels to prevent the development of a hydraulic jump under all design flow conditions;

(d) provide adjustable weirs at the outlet of all process tankage to adjoining channels, including on launders;

(e) provide weirs with a minimum free fall of 150 millimetres under all design flow conditions;

(f) provide a minimum freeboard of 150 millimetres in all open

channels at peak flow conditions;

(g) design channels to be accessible for ease of flushing and cleaning; and

(h) for conveyance channels downstream of the perforated plate screens and containing solids, provide an aeration diffuser system to prevent grit deposition. For additional design requirements, refer to Appendix 18A – Process Functional Requirements Section 2.2.7.

C.10.6.4 Process Air Conveyance

C.10.6.4.1 Design Builder shall:

(a) limit friction headlosses to 10 percent of the system pressure;

(b) include itemized headlosses for all bends, reducers, increasers, valves, meters, tees, and entrance and exit losses and other system losses; equivalent length estimates will not be permitted;

(c) limit line pressures to 690 kPa or the pressure rating of the pipe, whichever is lower; and

(d) design aeration piping systems to account for all headlosses including the following:

(i) diffuser losses: based on the diffuser manufacturer's data plus a minimum fouling allowance of 200 millimetres of water for coarse bubble diffusers and a fouling loss for medium and fine bubble diffuser as recommended by the manufacturer;

(ii) diffuser submergence;

(iii) silencer and filter losses, based on manufacturer's data;

(iv) piping and valving losses; and

(v) control valve sizing.

C.10.7 Process Piping Design Requirements

C.10.7.1 Piping and Valve Layout

C.10.7.1.1 Design Builder shall:

(a) arrange piping with runs as direct as possible without abrupt changes in direction;

(b) not locate piping under foundations or process equipment, except

where it is not possible to do otherwise to maintain the required functionality of the equipment;

(c) not locate liquid pipelines within electrical rooms or above electrical equipment, motor control centers, panels or other equipment susceptible to damage from leaks;

(d) arrange valves, pumps and instruments with pipe supports on both sides to enable removal without dismantling adjacent piping;

(e) equip floor penetrations with a concrete curb or stainless steel sleeve at least 200 millimetres high to prevent liquid on the floor from running down the floor penetration;

(f) maintain grade on all draining pipes and run horizontal water piping with a minimum grade of 2 percent to drain;

(g) install an eccentric reducer with the flat size on top wherever a pipe size reduction is required, unless otherwise directed;

(h) install pipe systems capable of being isolated and dismantled for repair without supply side shut down;

(i) provide piping connections to equipment such that the equipment does not carry or resist forces from the connecting piping;

(j) provide dielectric flanges at joining of dissimilar piping materials; and

(k) provide double-backflow preventers on potable water lines upstream of any connection to process piping and non-potable water piping.

C.10.7.2 Sludge Conveying Pipes

C.10.7.2.1 For all sludge, grit, and scum conveyance piping systems, Design Builder shall:

(a) provide a manual air relief on dead legs and high points in solids pipelines and pipe the air release to the nearest process waste drain;

(b) provide an automated flushing system for fluidization and flushing of the suction and discharge piping for grit systems that are designed for intermittent operation, and

(c) provide long radius bends.

C.10.7.3 Air Piping Requirements

C.10.7.3.1 For all air and gas piping systems, including process air, agitation air,

instrument air, and foul air, Design Builder shall:

(a) install automatic drip traps for water removal from air system piping on low points of every pipeline;

(b) slope service air and instrument air mains downward in the direction of flow so that both flow and gravity will carry moisture to traps or water legs;

(c) place drip legs with manual blow-off at low points in the piping system for moisture draw-off; drain moisture to a process drain;

(d) arrange branch connections to tee off main lines either vertically or horizontally; and

(e) size piping to ensure that the supply pressure requirements of connected equipment are met.

C.10.7.4 Flow Meters

C.10.7.4.1 Design Builder shall:

(a) refer to Section C.13 for design requirements on flow measurement instruments;

(b) provide magnetic flow meters for all liquids, including grit, slurries, scum and sludge, except where a magnetic flow meter is incompatible with the process fluid, in which case, provide another meter that is compatible with the process fluid;

(c) locate flow measurement instruments with a minimum of 5 straight pipe diameters upstream and 3 straight pipe diameters downstream of any pipe fittings or as recommend by the manufacturer or Good Industry Practice;

(d) provide flushing taps and drains between isolation valves to periodically flush flow meter, with the exception of air flow meters;

(e) provide ball valves capable of being locked-out on flushing taps;

(f) maintain process operation at all times when servicing or replacing flow meters, if the conveyance piping needs to be isolated for servicing or replacing meters, provide bypass piping configuration to allow meter removal without disrupting operation;

(g) provide flushing taps and ball valves capable of being locked-out on either side of the bypass line isolation valve; and

(h) each flow measurement instrument shall have a measurement accuracy of 1 percent (plus/minus) of actual (based on the combined measurement from that instrument and any related

primary or secondary flow measurement instrument).

C.10.7.5 Pressure Meters

C.10.7.5.1 Design Builder shall:

(a) refer to Section C.13 for design requirements for pressure measurement instruments; and

(b) each pressure measurement instrument shall have a measurement accuracy within 1 percent (plus/minus) of actual (based on the combined measurement from that instrument and any related primary or secondary pressure measurement instrument)

C.10.7.6 Pipe Size

C.10.7.6.1 Design Builder shall:

(a) restrict pipe sizes to the nominal pipe sizes listed in the WTSP *Identification Standard* found in Appendix 18D – City Standards;

(b) size pipes to efficiently transfer flows without excessive head loss and to prevent the accumulation of solids by maintaining an appropriate minimum liquid velocity;

(c) design pump suction pipework to prevent cavitation;

(d) use eccentric reducers at pump suctions to prevent air binding;

(e) size all pipelines for maximum and minimum flows based on maximum and minimum velocity limits and pressure drop;

(f) include provisions for withstanding vacuum conditions by providing appropriate pipe wall thickness, vacuum relief devices, or pipe stiffener rings;

(g) eliminate water hammer and all transient pressures;

(h) provide adequate strength and minimum support spacing;

(i) provide utility supply lines that are 15 millimetres nominal or larger; and

(j) provide wall thickness when grooved couplings are used per AWWA C606, except use Class 56 wall thickness for 450 millimetre pipes and larger.

C.10.7.7 Vents and Drains

C.10.7.7.1 Design Builder shall:

(a) provide minimum 25 millimetres vent connections where vents are required;

(b) provide minimum 50 millimetres drain connections where drains are required; and

(c) provide a minimum 200 millimetres plant process waste drains where plant process waste drains are required.

C.10.7.8 Thermal Protection

C.10.7.8.1 Design Builder shall:

(a) provide insulation and heat tracing for all piping that has potential to freeze;

(b) locate the crown of buried pipe far enough below grade to protect it from freezing;

(c) provide frost-protected hydrants for outdoor utility stations;

(d) insulate hot piping systems operating at temperatures greater than 54ºC to avoid burn injuries; and

(e) insulate cold water piping to prevent condensation.

C.10.7.9 Pipe Cleaning

C.10.7.9.1 Design Builder shall provide pipe cleaning facilities for pipelines subject to grease, screenings, grit or scale/struvite accumulations. Such pipe cleaning facilities to include pigging facilities. Pig launching and pig catching stations shall be provided for each line to be pigged and hose bib and drain shall be provided at each station.

C.10.7.10 Plant Drainage

C.10.7.10.1 Design Builder shall:

(a) direct sanitary and process drains (floor, trench and gutter drains in process areas, equipment pad drains, and tank drains) to the plant sanitary drainage system. For clarity, septic tanks and holding tanks shall not be used. Design Builder shall provide a design such that no discharge flows into the interceptor sewers, influent junction chamber or raw sewage pumping station wet wells;

(b) slope drains at a minimum of 2 percent;

(c) provide a minimum process drain size of 200 millimetres; and

(d) provide oil separators in areas where oil leakage may contaminate the floor drainage system.

C.10.7.11 Plant Drainage Pumping

C.10.7.11.1 Design Builder shall:

(a) pump all plant drainage;

(b) discharge plant drainage as follows:

(i) for sanitary wastewater and for those process waste streams that have the potential to contain grit or screenings, the discharge from the pumping stations shall be to the raw sewage pumping station discharge conduit at the headworks, and at a location downstream of the raw wastewater composite sampler and upstream of the screenings and grit removal facilities;

(ii) for all other process streams, discharge into the channel immediately downstream of the grit removal facility;

(iii) all new plant drainage shall be directed to locations downstream of the raw sewage pumping station wet wells, downstream of the raw sewage composite sampler and downstream of the raw sewage flow meters; and

(iv) provide flow meters on all return pumping stations.

(c) reroute the existing treated centrate and centrate waste activated sludge piping from the interceptor sewer to the primary influent stream;

(d) each plant drainage pumping station(s) shall include the following:

(i) wet well;

(ii) transfer pumps; and

(iii) all ancillary equipment.

(e) provide wet wells that:

(i) provide a manhole for the incoming gravity sewer immediately before entering the wet well;

(ii) provide geometry to minimize floatables and solids accumulation by promoting the passage of solid material;

(iii) provide a maintenance hatch for each submersible pump;

(iv) provide a maintenance hatch, an internal ladder, and lifting davit for plant staff access;

(v) provide a lifting davit to lift, remove and replace pump;

(vi) if located outdoors, provide a passive ventilation system and a manually initiated ventilation fan for minimum 12 air changes per hour drawing from the wet well; and

(vii) if located inside a building, exhaust head space of wet well to an odour control system at minimum 6 air changes per hour.

(f) use both ultrasonic and backup floats for liquid level measurement in the pumping station;

(g) provide overhead openings in the wet well to facilitate the removal of pumps, valves and appurtenances using a dedicated lifting device;

(h) size each overhead opening to be large enough to remove the largest pieces of equipment with a minimum of 400 millimetres clearance on all sides;

(i) provide a discharge configuration that eliminates backflow conditions when the pump is off;

(j) ensure the gravity sewer(s) feeding the wet well are not submerged under all flow conditions;

(k) in each pumping station that has a daily flow of 100 L/d or less, provide transfer pumps, all of which are identical, with the following performance characteristics:

(i) a minimum of one duty pump to meet instantaneous peak flow rates;

(ii) one standby pump;

(iii) submersible pumps that are mounted on twin 316 stainless steel rails and quick connects for pump connection from the top of the pumping station; and

(iv) operate to accommodate all incoming flows.

(v) in each pumping station that has a daily flow greater than 100 L/d, provide transfer pumps, all of which are identical, with the following performance characteristics:

(vi) a minimum of two duty pumps to meet instantaneous peak flow rates;

(vii) one standby pump;

(viii) VFD and non-reversing duty motor;

(ix) submersible pumps that are mounted on twin 316 stainless steel rails and quick connects for pump connection from the top of the pumping station; and

(x) operate to accommodate all incoming flows;

(l) provide a control panel within 10 meters of the pumping station located inside a building or provide outdoors in a weather proof enclosure;

(m) provide a magnetic flow meter on the discharge forcemain; and

(n) the ability to pass 75 millimetres solids under all flow conditions.

C.10.7.12 Valves

C.10.7.13 Design Builder shall:

(a) provide electrically actuated valve operators of a similar size and duty from a single manufacturer;

(b) provide pneumatically actuated valve operators of a similar size and duty from a single manufacturer;

(c) provide hydraulically actuated valve operators of a similar size and duty from a single manufacturer; and

(d) provide solenoid valves of a similar size and duty from a single manufacturer.

C.10.7.14 Control Valves

C.10.7.14.1 Design Builder shall:

(a) design so that valve operates in linear portion of the flow characteristic curve; and

(b) size to avoid cavitation under all operating conditions.

C.10.7.15 Slide and Sluice Gates

C.10.7.15.1 Design Builder shall:

(a) equip channels with engineered slide gates for isolation or flow

control;

(b) equip channels with downward opening weir gates for level or flow splitting control;

(c) provide sluice gates for isolating tanks, wet wells and other structures;

(d) ensure that the manufacturer's engineer designs and certifies all gates and seals all shop drawings certifying its rating. Such seal shall be an engineering seal from the province or state where manufacturer is located; and

(e) provide gate actuators of a similar size and duty from a single manufacturer.

C.10.7.16 Pumping System Design

C.10.7.16.1 Design Builder shall:

(a) provide design capacity for all pumping systems;

(b) provide pumps with a maximum speed of 1200 rpm when motor size is 75 kW or greater;

(c) for pumps requiring seal water, provide seal water control units and drains in accordance with Standard Construction Specifications;

(d) provide a means to manually bypass the seal water system solenoid valve and rotameter;

(e) provide non-potable City water for all seal water systems;

(f) arrange pump discharge piping so that all discharges for a given set of pumps are at the same elevation and connect to the discharge header before any vertical change in elevation;

(g) provide pump systems requiring flow measurement with a flow meter on pump discharge as follows:

(i) where a dedicated standby pump is provided a single flow meter may be provided for each duty/standby pump combination; and

(ii) where a common standby is provided between two or more duty pumps with flow meters, provide a dedicated flow meter for each pump, or arrange the piping so that when the standby pump operates the flow will be measured by the flow meter for the pump that is out of service;

(h) where standby pumps are required, provide identical pumps based on the largest duty pump;

(i) provide all valves, gates, control elements and any other appurtenances with necessary systems as required to permit automatic switchover between all interconnected duty and standby pump systems from PCS;

(j) provide automatic rotation of duty and non-duty pumps by the PCS; and

(k) provide rupture disks, pressure relief valves and pressure switches on all positive displacement pumping systems.

C.10.7.17 Blower and Compressed Air System Design

C.10.7.17.1 Design Builder shall:

(a) provide air dryers for compressors;

(b) select blowers to prevent surge conditions when starting and stopping and transitioning the number of in-service blowers and during parallel operation;

(c) provide design capacity for all process blower systems; and

(d) provide design capacity for all compressed air systems.

C.10.7.17.2 Design Builder shall comply with the following minimum requirements for the blower systems:

(a) equip all blowers with intake filters and dedicated silencers;

(b) equip all blowers with the following:

(i) discharge silencers;

(ii) blow-off silencers, as applicable, located as close to the blowers as possible to minimize noise;

(iii) motorized blow-off butterfly valves on the discharge, as applicable;

(iv) discharge check valves and isolation valves;

(v) stainless steel expansion joints on the intake and discharge of all blowers to isolate equipment piping; and

(vi) flexible coupling on the suction and discharge of each blower;

(c) provide all blowers with a pressure-relief valve located downstream of the blower between the discharge silencer and the discharge isolation valve.

C.10.7.17.3 Design Builder shall comply with the following minimum requirements for the compressed air systems:

(a) equip all compressed air systems with a duty/standby air dryer and filter arrangement;

(b) equip all compressed air systems to provide instrument air that meets the following at a minimum:

(i) dewpoint: less than -40°C;

(ii) oil: less than 1 ppm;

(iii) particulate: 99.5 percent of 0.01 micron removed;

(iv) meet the International Society of Automation requirements for instrument air; and

(v) suitable capacity to satisfy all compressed air demands;

(c) provide dry instrument air receivers (buffer tanks) near the air compressors (Firm Capacity) and in all process rooms with equipment having continuous or intermittent daily compressed air demands (including utility stations). Size the air receivers to ensure the minimum pressure requirement in each process area is met at all times;

(d) provide air receivers that are American Society of Mechanical Engineers rated and have a CRN number;

(e) include all pipe, fittings, valves, hoses, couplings, filters, air-drying component pressure regulators, and connections to equipment requiring compressed air;

(f) for all rooms in the Infrastructure that require compressed air, provide a 20 millimetres diameter air pipe or larger as determined by Design Builder to meet all equipment and typical user demands in accordance with Good Industry Practice;

(g) use globe-type valves; and

(h) provide a moisture indicating system.

C.10.8 Major Process Equipment Design

C.10.8.1 Equipment Supports, Anchors and Bases

C.10.8.1.1 Design Builder shall:

(i) install all equipment according to manufacturer's specifications;

(j) install all equipment on housekeeping pads; and

(k) restrain all mechanical and electrical equipment, ductwork and pipework.

C.10.8.2 Noise

C.10.8.3 Design Builder shall:

(a) provide equipment with noise of less than 80 dBA at 1 m distance from equipment;

(b) if sound attenuation equipment enclosures are used, they shall be designed by the equipment manufacturer to be an integral part of the equipment, as part of a standard package, and designed to not impede any standard inspection or maintenance activity;

(c) notwithstanding Section C.10.8.3(a) and Section C.10.8.3(b) if it is not practicable to provide equipment and enclosures that limit noise to 80 dBA at 1 m from the equipment enclosure, Design Builder may provide additional sound attenuation within the applicable room such that the noise outside of the room is limited to the levels specified in Section C.6.13.3 for interior spaces or limited to the levels specified in Section C.3.2.1(a) for outdoor spaces; and

(d) not install standby generator units with equipment enclosures. Locate such units in a sound attenuated room such that the noise outside the room is limited to the levels specified in Section C.6.13.3 for interior spaces or limited to the levels specified in Section C.3.2.1(a) for outdoor spaces.

C.10.8.4 Vibration

C.10.8.4.1 Design Builder shall:

(a) install equipment to operate smoothly without excessive wear, adjustment and attention;

(b) statically and dynamically balance rotating equipment for minimum vibration and low operating noise level;

(c) balance centrifugal pumps to grade g 2.5 as specified in ISO 1940;

(d) ensure vibration does not exceed the manufacturer's specified limits for individual products;

(e) ensure vibrations in pumps are within acceptable field vibration limits as outlined in the standards of the hydraulics institute;

(f) provide flexible connectors for pipes to all equipment supported by vibration isolators;

(g) provide flame-proof-flexible connectors between fans, heaters, equipment and ducts;

(h) provide piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passing through walls and floors do not transmit vibrations;

(i) support piping connected to isolated equipment with spring mounts with 25 millimetres minimum static deflection as follows:

(i) up to 100 millimetres:

(A) first 3 points of support.

(ii) 125 millimetres to 200 millimetres:

(A) first 4 points of support; and

(iii) 250 millimetres and greater:

(A) first 6 points of support.

(j) the first point of support shall have a static deflection of twice the allowable deflection of isolated equipment, but not more than 50 millimetres;

(k) where isolated equipment is bolted to floor, use vibration isolation neoprene washers (grommets);

(l) block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made;

(m) ensure that there is no physical contact between isolated equipment and building structure; and

(n) ensure that vibration isolation is not bridged by the anchoring.

C.10.8.5 Corrosion Control

C.10.8.5.1 Design Builder shall:

(a) engage a NACE certified corrosion engineer to complete a corrosion control study to outline specific design recommendations. Design Builder shall incorporate these recommendations in its design of the Infrastructure.

(b) ventilate all pipe galleries, enclosed headspaces, vaults and process buildings to provide a non-corrosive atmosphere;

(c) provide adequate air changes, heating and dehumidification to control the environment in all process areas;

(d) provide corrosion resistant piping materials as appropriate for the specific service conditions;

(e) provide valves, carbon steel piping and process equipment that are primed, painted or coated with an appropriate epoxy coating or lining to provide protection against corrosion;

(f) provide concrete that resists corrosion from hydrogen sulphide and sulphates;

(g) provide additional concrete cover over reinforcing steel to prevent corrosion of reinforcement;

(h) provide a cathodic protection system(s) to protect buried ferrous metals;

(i) provide 316 stainless steel for bolts and fasteners that are in contact with wastewater. If 316 stainless steel will not provide the required Service Life, submit to the City a RFS indicating the proposed alternate material;

(j) provide corrosion resistant foul air handling and ventilation equipment, ducts, piping, valves and gates, tank covers, pumps and mixers; and

(k) provide covers that are corrosion-proof and are capable of being stacked at least 8 high when resting on a flat surface and stacked at least 2 high when spanning the process unit.

C.10.8.6 Odour Control

C.10.8.6.1 Design Builder shall comply with the following minimum requirements for odour control:

(a) cover all liquid stream equipment, tankage, channels, chambers and other sources of potential odour emissions;

(b) cover all solids stream equipment, tankage, channels, chambers and other sources of potential odour emissions;

(c) extract air from covered equipment, tankage, channels, chambers and other odour sources within buildings and convey to the odour control system;

(d) ventilate all raw, preliminary, and primary, and solids covered systems to maintain a negative pressure to the adjacent room;

(e) provide a balanced foul air duct system;

(f) use the following construction materials for the following odour control duct systems:

(i) above grade interior – fibreglass reinforced plastic or 316 stainless steel;

(ii) above grade exterior – 316 stainless steel; and

(iii) below grade – 316 stainless steel pipe.

(g) provide fresh air supply to all enclosed equipment tankage, channels and rooms to meet the maximum foul air extraction rate;

(h) ventilate enclosed tanks and channels operating at normal water levels via foul air extraction ducting and ensure:

(i) there is a negative pressure under tank and channel covers to adjoining rooms;

(ii) minimum of 6 air changes per hour below all tank or channel covers unless otherwise specified in the Technical Requirements;

(iii) maintain a negative pressure from equipment and channels, when an access hatch is open for inspection or maintenance; and

(iv) sufficient air changes per hour in each room to reduce condensation into the room space.

(i) provide manual air flow control dampers near each inlet duct to balance the foul air flow from each location;

(j) provide foul air flow monitoring on:

(i) common foul air discharge to odour treatment processes; and

(ii) individual foul air extraction ducts from each process area.

(k) provide foul air flow signal to the PCS.

C.10.8.7 Chemical Storage and Feed

C.10.8.7.1 Design Builder shall:

(a) make adequate provision for such properties as corrosiveness, crystallization, temperature, boiling point, freezing point and other properties that require special handling or materials of construction;

(b) maintain adequate separation of all substances that could cause a safety hazard if they were to come in contact by arranging equipment, piping and valving accordingly;

(c) ensure that the delivery stations clearly identify the chemical by name and formula, and include a warning about mixing chemicals of different types;

(d) provide sample ports to test tank contents;

(e) insulate and heat trace all chemical piping exposed to the outside or to inside to maintain temperature above freezing point, crystallization point and point of excessive viscosity of the chemical;

(f) provide a method to drain all of the chemical contained in piping to safe areas, and to flush to drain after use;

(g) provide for controlled discharge of contained spill to ultimate disposal;

(h) provide slip resistant epoxy on floors in chemical storage and use areas;

(i) provide containment infrastructure when connecting and disconnecting during truck off-loading;

(j) locate and arrange chemical storage and feed systems such that gases that are released are not entrained into the building HVAC system; and

(k) control temperature and humidity and provide a dry environment in all chemical storage areas.

C.10.8.8 Chemical Storage

C.10.8.8.1 Design Builder shall:

(a) provide storage based on the minimum chemical storage requirements set out in Table 8 for 2037 design conditions:

Table 8: Minimum Chemical Storage Requirements

System	Process Function	Chemical	Delivery Form	Dry Storage (days) at Usage Condition	Minimum Liquid Volume (Active) Storage Requirements	No. of duty storage tanks	Usage Condition
Standby power generators	Selective catalytic reduction	Urea	Liquid	n/a	3 days x usage condition	2	Maximum Day consumption during the maximum power load demand of the Infrastructure
Other liquid			Liquid	n/a	Greater of 30 days x usage condition or 120 % of standard chemical delivery truck[1]	2	Average daily consumption during the Maximum Month chemical consumption period
Other dry			Dry	30	3 days x usage condition (after dry make-up)	2	Average daily consumption during the Maximum Month chemical consumption period

C.10.8.8.2 Design Builder shall comply with the following chemical storage tank requirements:

(a) chemical totes and drums may be used in lieu of tanks when the minimum liquid volume (active) storage requirements set out in Table 8 can be met with a maximum of either four identical duty totes or four identical duty drums;

(b) equip permanent chemical storage tanks larger than 1000 L with unimpeded access with minimum 750 millimetres manways provided in the top and side for each tank. Where manways are installed on the top of the tank, provide handrails;

(c) slope tank bottoms toward the lowest outlet or drain connection;

(d) provide overflows to containment;

(e) provide tanks top-loaded and provided with a drop pipe to discharge chemicals near the bottom;

(f) arrange tanks so that all chemical tanks of one type are located inside a common containment area;

(g) provide a minimum containment capacity of 125 percent of the volume of the largest tank with allowances for space occupied by other tanks in the containment area;

(h) provide continuous level measurement and signal to PCS in all containment areas. Provide alarm to PCS on high level;

(i) provide tank drains to accommodate tank cleaning and inspection;

(j) locate tank drains at an elevation that will not require pumping to remove residual liquid;

(k) provide containment areas with a blind sump for use with a portable pump to dispose of spills and washdown waste;

(l) ensure chemical containment areas are accessible by vacuum truck;

(m) equip all tanks with vents for filling. Vents shall not discharge into rooms;

(n) provide level indication for all chemical storage tanks;

(o) provide individual loading stations connections for each chemical;

(p) provide spill containment at each unloading station;

(q) provide verification system to ensure chemicals are stored in the correct tank;

(r) provide sample valves to perform testing of tank or line contents; and

(s) if an equivalent dry chemical is available to serve a process function set out in Table 8 and Design Builder selects a liquid chemical system, then Design Builder shall ensure sufficient additional space is provided for City to install the equivalent dry chemical system in the future.

C.10.8.9 Chemical Feed Piping and Valves

C.10.8.9.1 Design Builder shall:

(a) provide polyvinyl chloride for interior chemical piping;

(b) where buried chemical service is necessary, use double wall containment piping with zoned leak detection;

(c) provide double-walled containment piping system for chemical piping located over top of walkways and in all locations where a leak could pose a hazard to equipment or personnel; and

(d) equip valves with visual position indication.

C.10.9 Process Functional Requirements

C.10.9.1 Design Builder shall comply with the Process Functional Requirements in accordance with Appendix 18A - Process Functional Requirement.

C.11 Building Mechanical

C.11.1 Codes and Standards

C.11.1.1 Design and construction shall conform to the requirements of the *WSTP Building Mechanical Design Guideline* found in Appendix 18D – City Standards, including codes, and standards referenced therein, as well as any additional codes or standards referenced in this section. The latest versions of codes and standards recognized as part of the Manitoba Building, Fire and Plumbing Code at the time of Design Builders Design shall be used in the design of the building mechanical systems.

C.11.2 Objective

C.11.2.1 The building mechanical design requirements in this section apply to HVAC, fire protection, natural gas piping and plumbing for all new and repurposed facilities in the NEWPCC.

C.11.2.2 Detailed material, equipment and installation specifications are found in Appendix 18B –Specifications and shall form part of these Technical Requirements.

C.11.3 Design Criteria for HVAC Systems

C.11.3.1 Design Basis

C.11.3.1.1 Design Builder shall:

(a) follow the requirements of the *WSTP Building Mechanical Design Guideline* (Appendix 18D) for all building mechanical systems supplemented by the contents of this document.

(b) provide HVAC systems utilizing hydronic heating to satisfy all space and ventilation heating loads whenever practical. Requirements and exceptions to this stipulation are outlined in the *WSTP Building Mechanical Design Guideline*;

(c) provide dedicated boiler systems for new Parcel A facilities;

(d) provide high efficiency (minimum 90%) condensing boilers in hydronic installations;

(e) provide heating systems that are associated with condensing boilers designed to operate at hot water temperatures that will promote recovery of the latent heat of combustion from flue gases and maximizes boiler efficiency;

(f) provide cooling requirements with direct expansion refrigerant systems meeting the requirements of *WSTP Building Mechanical Design Guideline* section on air conditioning systems and in accordance with the DBA;

(g) adhere to the construction requirements, performance requirements and electrical classification determinations set out in NFPA 820 based on the application criteria in the *WSTP Building Mechanical Design Guideline*, including any amendments carried within this document;

(h) refer to the *WSTP Building Mechanical Design Guideline* for redundancy requirements. Loss of redundancy shall not inhibit the operability of the plant. Provide SOPs in the event of loss of redundancy;

(i) use outdoor design parameters as stated in the *WSTP Building Mechanical Design Guideline*;

(j) use indoor environmental design parameters as stated in the *WSTP Building Mechanical Design Guideline*;

(k) provide HVAC systems that meet the noise criteria established for the Infrastructure in the Technical Requirements, the WSTP Architectural Design Guideline, and the *WSTP Building Mechanical Design Guideline*; and

(l) locate all major HVAC equipment above grade including boilers, air handlers, heat recovery ventilators and make-up air units. Make all HVAC equipment readily accessible, with sufficient clearances around equipment to facilitate all maintenance activities, including sufficient room and lay down area to remove the largest piece of equipment. For heavy components provide lifting systems in accordance with the Equipment Lifting and Replacement Plan;

(m) provide ventilation systems serving process areas to maintain space pressure relationships as stated in the *WSTP Building Mechanical Design Guideline*;

(n) pressurizing solutions as outlined in NFPA 496 – Standard for purged and Pressurized Enclosures for Electrical Equipment may be applied to provide the equivalence of a physical separation between spaces of two different classifications while maintaining access provided it is approved by the authority having jurisdiction;

(o) provide ventilation systems to maintain a space pressure of a minimum +25 Pa for control rooms, electrical rooms, office spaces and other non-category spaces relative to adjacent Category 1 or Category 2 spaces;

(p) design ventilation systems in areas where vehicles or fuel driven equipment may be stored or operated to maintain carbon monoxide (CO) levels below 12.5 parts per million (ppm) and purge the area at levels of 25 ppm or higher;

(q) design ventilation systems to control the levels of nitrogen oxides (NO_x) to 0.25 parts per million, set alarms to actuate at 1.5 ppm, one half of the 8-hour threshold limit value according to the ACGIH standards;

(r) in areas where H2S may be generated or collected, design ventilation systems to control the levels of H2S to the TLV-TWA exposure limit as dictated in the *WSTP Building Mechanical Design Guideline*.

C.11.3.2 For outdoor environmental design parameters, Design Builder shall:

(a) design the HVAC systems using the outdoor design conditions provided in the *WSTP Building Mechanical Design Guideline*.

C.11.3.3 For indoor environmental design parameters, Design Builder shall:

(a) provide the HVAC systems to provide the indoor environmental conditions stipulated in the Indoor Temperature section of the *WSTP Building Mechanical Design Guideline*;

(b) indoor design environmental conditions provided in the *WSTP Building Mechanical Design Guideline* will be supplemented, but not supplanted, by information or procedures outlined in ASHRAE Standard 55-2013 Thermal Environmental Conditions for Human Occupancy;

(c) provide ventilation systems for normally occupied spaces, that are not governed by NFPA 820 such that they adhere to the requirements of ASHRAE Standard 62.1 – Ventilation for Acceptable Indoor Air Quality;

(d) use good engineering practice in the design of systems that maintain air quality and prevent the accumulation of toxic gases and/or biological hazards, exceeding the prescribed air change rates of NFPA 820 as the application demands;

(e) provide air distribution systems that avoid localized drafts in regularly occupied areas;

(f) pressurize egresses and areas of refuge as required by code;

(g) provide systems to control relative humidity per the requirements of the *WSTP Building Mechanical Design Guideline*.

C.11.3.4 Special Studies

C.11.3.5 Design Builder shall carry out the following special studies for the building mechanical systems in accordance with Appendix 18K - Special Studies and Models:

(a) fire protection study.

C.11.3.6 Calculation and Design Submittals

C.11.3.6.1 Design Builder shall complete and document design calculations as stated in the *WSTP Building Mechanical Design Guideline* and as indicated in this document. The calculation documents shall be made available to the City Representative upon request and shall be presented in a coherent manner with all methods used, reference material lists and design assumptions stated.

C.11.3.6.2 Design Builder shall:

(a) provide flow and/or process diagrams for HVAC systems showing all equipment, ductwork, piping, dampers, and valves; and

(b) indicate all flow rates to prove a balanced system.

C.11.3.6.3 Design Builder shall submit with a Design Submittal, upon request by the City, the following calculations for review on major systems:

(a) equipment sizing following procedures outlined In the ASHRAE Fundamentals Handbook;

(b) load calculations based on output from a recognized HVAC analysis and simulation software (i.e. Carrier HAP or Trane Trace);

(c) psychometric charts for air conditioning processes;

(d) pressure loss calculations for complete hydronic and ventilation systems in accordance with the ASHRAE Fundamentals Handbook; and

(e) submit the above calculations for other non-major systems on request from the City Representative.

C.11.3.6.4 Design Builder shall provide:

(a) Single-line sketches of mechanical systems showing all

components of the system;

(b) tabular component description for fluid characteristics, pipe/duct size, pipe/duct material, flow, length, velocity, losses and friction/pressure loss coefficients or equivalent length for fittings; and

(c) system head curve showing losses and pump/fan curves.

C.11.3.6.5 Design Builder shall:

(a) provide all other calculations, upon request by the City, based on the applicable references in the ASHRAE handbooks and ACGIH Industrial Ventilation. For items that are not addressed by these two publications, the calculations shall be presented with the supporting resource fully identified including the specific location within the documents.

C.11.3.6.6 Design Builder shall document the design conditions for each space in spreadsheet format, include the following information at a minimum:

(a) name of space;

(b) electrical classification;

(c) electrical category;

(d) temperatures;

(e) supply and exhaust ventilation rates;

(f) listing and concentrations of all odourous or toxic airborne contaminants;

(g) odour control exhaust rate;

(h) differential pressure relative to ambient air pressure;

(i) relative humidity;

(j) noise level;

(k) number of occupants;

(l) occupant activities; and

(m) equipment description and operational strategy.

C.11.3.7 Equipment Installation

C.11.3.7.1 Design Builder shall comply with the following general requirements for

HVAC equipment installation:

(a) follow the Building Mechanical Design Guideline for equipment installation parameters supplemented by the following instructions:

(i) provide ventilation equipment for classified areas that continue to function after a post-disaster event in accordance to ASCE/SEI 7-05 and ICC-ES AC 156;

(ii) do not install ventilation equipment in mechanical rooms with gas fired boilers unless that ventilation equipment is dedicated to serve only that boiler room;

(iii) install all equipment per the manufacturer's instructions to ensure maximum performance and code compliance;

(iv) use electric resistant heaters located in air handlers located in electrical, server and PCS automation rooms;

(v) use multi-stage or SCR controlled heaters when electric heating coils are used;

(vi) do not locate hydronic heating or cooling systems within or within spaces above electrical rooms, automation rooms or control rooms;

(vii) air handling units and fan coils serving electrical, server and PCS automation rooms may use hydronic coils provided they are not located within this or any other restricted space and provision is made to protect the served space from duct-borne moisture in the event of a hydronic system leak;

(viii) install all equipment to provide clear access for inspection and service of any replaceable component;

(ix) install equipment such that egress and plant staff circulation paths are not obstructed;

(x) locate all equipment that requires access for inspection and maintenance such that it is accessible from a finished floor, or an engineered, fixed, elevated service platform with stair access;

(xi) service platforms shall be sized to allow safe removal of equipment components;

(xii) install all equipment, devices and material such that it can be removed and replaced if required without temporary or permanent modification to the structure of the space or building housing this equipment or material;

(xiii) install any device or piece of equipment providing redundant, standby or parallel service to a system in a manner that will allow remaining equipment or devices to operate and serve the system if this piece of equipment is off-line and must be removed from its installed location. this includes boilers, pumps, heat exchangers, heat recovery ventilators, air handlers, make up air units and fans; and

(xiv) any non-critical solitary piece of equipment that can be taken off-line temporarily and still allow the system to operate safely in a diminished capacity shall have provision for bypass to allow such operation at the operator's discretion.

C.11.3.7.2 Design Builder shall follow the equipment location parameters as outlined in Table 9:

Table 9: Building Mechanical Equipment Locations

Equipment Type	Primary Location	Alternate Location 1[1]	Alternate Location 2[1]
Boilers	Dedicated Boiler Room at Grade	Dedicated Boiler Room Above Grade	NA
Primary Hydronic Circulation Pumps	Associated Boiler Room	NA	NA
Secondary Hydronic Circulation Pumps	Associated Boiler Room	Point of Use[2]	NA
Hydronic Heat Exchangers	Associated Boiler Room	Point of Use[2]	NA
Ancillary Boiler Equipment	Associated Boiler Room	NA	NA
Air Handling Units[3]	Dedicated Mechanical Room	Area Served[4]	Rooftop[5] or at Grade
Fans (Supply or Exhaust)	Building Interior	Roof Mounted	Sidewall Mounted

Notes:

1. Alternate locations are shown in order of preference (i.e. Location 1 is given preference over Location 2).
2. In cases where it is physically or operationally beneficial to locate this equipment near the device served, the alternate location may be considered provided the supporting infrastructure is in place (i.e. drainage, leak containment, etc.) and the equipment has no impact to the functionality of the space.
3. This includes mixed air systems (outside air and return air), 100% outside air make up air units and air to air heat recover ventilators.

4. Typically, air handlers will only be allowed to be installed such that they are exposed in the spaces served when the environment is benign to the equipment and its services, sound levels are acceptable for the space and service/access requirements as outlined in these technical requirements document are met. The air handler will not impede any process functions.
5. Rooftop or grade locations will only be considered when interior location options prove impractical due to code requirements, or conflicts with process functions. Roof access shall be via permanent stairs with man door access directly on to the roof. Exterior ladders or interior ladders with hatches are not acceptable. Coordinate with architectural design to ensure all fall safety measures are in place. Where ever possible locate equipment far enough from the roof edge such that safety barriers are not required.

C.11.3.8 Ventilation Configuration and Performance Requirements

C.11.3.8.1 Design Builder shall provide HVAC systems conforming to the following requirements:

(a) outside air introduced to a space for air quality control, exhaust makeup or combustion air shall be preheated or controlled such that it does not add heating load to the space and create risk of freezing conditions within the space;

(b) apply heat recovery technology to meet the *WSTP Building Mechanical Design Guideline*,

(c) air to air heat recovery systems intended to provide continuous ventilation for the purposes of reducing the classification of an area as defined by NFPA 820 shall have no interruption of the airflows for defrosting the heat exchangers;

(d) unless operating conditions prohibit their use, reversing flow mass-exchanger technology heat recovery ventilators with up to 90% effectiveness shall be used;

(e) air to air heat recovery system technology selection will maximize recovery efficiency and effectiveness while also considering ambient space conditions other than thermal characteristics including but not limited to:

(i) areas of normally high humidity generation may require technology that removes moisture from the exhaust airstream but not reintroduce it to the supply airstream in order to control space humidity levels; and

(ii) where the exhaust contaminants will damage the components of the high efficiency heat recovery devices other technologies such as runaround glycol loops may be considered.

(f) provide drainage for condensate from uncontaminated sources to

a dedicated funnel drain connected to the sanitary drainage;

(g) condensate drainage from exterior mounted heat recovery ventilators shall be heat traced and insulated to prevent freezing;

(h) separate ventilation from classified and non-classified areas and provide equipment and safety systems to automatically eliminate backflow of air between classified and non-classified ventilation systems;

(i) ensure exhaust ducts from classified spaces are physically separate from exhaust ducts from unclassified spaces

(j) exhaust fans handling foul, contaminated or classified air shall be located such that intake and exhaust ductwork does not pass through spaces of higher air quality or lower electrical classification;

(k) foul air exhaust ducting under positive pressure that is located indoors shall be avoided wherever possible, but if used sealed to a SMACNA Class – A standard or better;

(l) maintain pressurization in room areas and head spaces in tanks and channels during normal occupied and unoccupied conditions;

(m) include pressure sensors and other sensors in each space to monitor and control air changes and pressurization in each space using the PCS system;

(n) for any given space coordinate makeup air and general exhaust air requirements with foul air drawn by the odour control systems to achieve the required air change rates and pressurization;

(o) ductwork shall not pass through a physical separation, as defined by NFPA 820, that separates two dissimilar classified zones;

(p) arrange ductwork for the supply and exhaust systems being used to lower the classification of an area such that they do not penetrate a fire separation thereby requiring a fire damper;

(q) provide ventilation and control systems that will allow temporary reduction of ventilation rates to electrically classified areas as an energy-saving measure and still maintain the reduced level of classification provided the criteria stipulated in NFPA 820 are met;

(r) do not install fans in the wet wells;

(s) material safety data sheets for all chemicals shall be reviewed for recommended ventilation;

(t) speed control of a fan over 0.746 kW is to be done with variable

frequency drives or using electronically commutated motors, not multi-speed motors;

(u) ventilation systems installed in Type B and C filtration applications as defined in the *WSTP Building Mechanical Design Guideline* shall provide the ability to free cool in lieu of or before the activation of mechanical cooling systems and maintain indoor design temperatures;

(v) on systems using mechanical cooling, limit free cooling to the same air flow as required for mechanical cooling;

(w) provide air filters on all supply air systems with filter efficiencies stated in the *WSTP Building Mechanical Guideline* as a minimum;

(x) provide exhaust and air distribution systems to effectively capture and remove any toxic or combustible gases allowing for the gas buoyancy relative to air, source of the contaminant, occupant location and space obstructions. Coordinate the requirements with the process designers;

(y) provide a ventilation system that will introduce and exhaust air into and from hazardous areas in a manner that will encourage scavenging of all portions of the space to prevent short-circuiting and to promote the effective removal of both heavier-and lighter-than-air gases and vapours;

(z) provide odour control systems designed to capture contaminants at their source;

(aa) provide ventilation systems designed to contain odourous air and direct it away from normally occupied areas and to an odour control system;

(bb) coordinate with the architectural design such that space pressurization does not cause door opening force to exceed limits in the National Building Code of Canada;

(cc) design any mechanical systems located in high humidity or corrosive environments (Category 1 or 2) to comply with any applicable codes including the Canadian Electrical Code (CEC) and Winnipeg Electric Bylaw;

(dd) consult the *WSTP Building Mechanical Design Guideline* for material selection or equipment protection in humid or corrosive environments;

(ee) provide the building mechanical systems with any requirements dictated by the electrical Category (wet or corrosive environment) of the space in which they are to operate as defined by the CEC;

(ff) provide protection in the form of coatings, sealants or enclosures, as appropriate, to protect copper components, electrical, electronic or mechanical, from corrosion in areas with potential hydrogen sulphide exposure;

(gg) design HVAC systems to limit exfiltration of conditioned air and infiltration of outside air at overhead doors at loading bays using air doors or similar technologies. Doors intended to be used solely for the removal or replacement of large equipment for maintenance purposes will not require air doors;

(hh) locate fresh air intakes to prevent contamination by external sources such as road traffic, idling vehicles, smoke stacks, exhaust outlets, and odours from other facilities;

(ii) refer to ASHRAE 62.1 and follow good engineering practice for minimum air intake separation from sources of outside air contamination;

(jj) provide for ventilation system shut down upon detection of smoke for systems supplying or exhausting air at a rate greater than 943 liters per second;

(kk) equip all continuous ventilation systems serving hazardous areas that are used to downgrade the classification of a space with flow detection devices connected to alarm signaling systems to indicate ventilation system failure to provide the required air changes and to indicate that the ventilation system has not been in “occupied mode” for the minimum of 15 minutes (adjustable) before accessing the space;

(ll) provide all hazardous areas (entrances to spaces, within spaces) with local and remote alarms (visual and audible) for ventilation system failure, toxic gas detection, combustible gas detection and to indicate that the ventilation system has not been in “occupied mode” for the required minimum time;

(mm) provide separate smoke ventilation systems where applicable;

(nn) equip all continuous ventilation systems used to reduce space electrical classifications per NFPA 820 with automatic switching to a permanent alternate source of power;

(oo) provide separate ventilation for chemical storage areas; and

(pp) provide exhaust systems in server and auxiliary rooms or any other areas where non-water-based fire suppression systems are used; provide all ducts to and from the space with motorized dampers that will close before the release of the fire suppressant.

(qq) use centrifugal fans for odour control system fans, and exhaust air

systems, such as pump stations, with large airflow requirements; wherever the service permits, use fans with backwardly inclined blades;

(rr) provide vibration-isolating bases for all floor-mounted fans;

(ss) for all suspended fans, provide vibration-isolating hanging systems.

C.11.3.9 Design Criteria for Boiler System

C.11.3.9.1 Design Builder shall provide boiler systems meeting the following requirements:

(a) boiler plants dedicated to HVAC applications shall have a minimum of 2 boilers each sized for 70 percent of the design heating load;

(b) space allowances shall be made for one future boiler of the same size as the selected equipment and associated pump system;

(c) configure the primary hot water circulation with multiple centrifugal pumps with variable frequency drives in an N+1 arrangement, with a minimum of two duty pumps and a standby pump;

(d) variable volume pumping in the primary hot water circuits shall be achieved by the use of two-way control valves at the loads and pressure sensing feedback to the variable speed primary pumps;

(e) the primary hot water circuits shall service secondary glycol circuits through heat exchangers arranged in an N+1 configuration;

(f) for heat supply, control heat exchangers based on the heat exchanger’s outlet temperature;

(g) provide a chemical feeder;

(h) provide an air and dirt separator on the primary loop;

(i) provide a pressure reducing valve on the makeup water supply line to maintain the pressure in the primary loop at the desired setting;

(j) provide bladder-type expansion tanks on the primary and secondary loop to absorb expansion of water in the system; equip each tank with a pressure relief valve;

(k) equip all control loops connected to the primary variable loop with shut-off valves, strainers, check valves, two-way control valves and circulator pumps with variable speed drives;

(l) provide the condensing boiler control with strategies such as outdoor air temperature reset, warm weather shutdown, boiler system optimization (running multiple boilers vs. single boiler), and maintaining large water delta t (supply water temperature vs. return temperature);

(m) equip heated buffer tank with one heating coil to preheat domestic hot water (DHW);

(n) provide a domestic hot water tank with two double wall heating coils to be used for DHW generation;

(o) provide a circulator pump sized for 100 percent of the peak flow to be used to pre-heat DHW with the heated buffer tank heating water;

(p) provide a circulator pump sized for 100 percent of the peak flow to be used to re-heat domestic hot water with the boiler heating water in condensing boiler applications;

(q) provide a chemical feeder located on the bypass line around the circulator pumps; and

(r) provide an air and dirt separator installed on the primary loop.

C.11.3.9.2 Design Builder shall meet the following requirements for equipment selection:

(a) provide condensing boilers with a minimum thermal and combustion efficiency of 95 percent as tested to ANSI Z21.13/CSA 4.9;

(b) where propylene glycol is used for freeze protection, use correction factors in equipment sizing to account for lower thermal conductivity and increased viscosity;

(c) select pump motors so that the power requirements of the pump from shutoff to free discharge do not exceed the motor nameplate rating and does not impinge on the service factor under any conditions;

(d) provide pump motors with a maximum speed of 1,750 rpm;

(e) provide pump discharge piping with a check valve, a thermometer, a sight flow indicator, and an isolation valve;

(f) provide pressure gauges at the suction and discharge of all pumps; and

(g) provide air release valves where air may accumulate in the lines.

C.11.3.10 Design Requirements for Space Heating and Cooling Systems

C.11.3.10.1 Design Builder shall provide heating and cooling components that meet the following requirements:

(a) provide protective coatings for all HVAC units, finned tube coils, and heating-cooling coils located in corrosive environments or handling potentially corrosive air;

(b) ensure that heat transfer capacity the coils meet the specified design value with any coating applied;

(c) provide a baked on phenolic coating suitable for 3000 hours salt spray per ASTM-B117 to protect all copper against exposure to corrosive atmospheres;

(d) provide hot water unit heaters with 25 percent greater capacity than design heat loss when heating is intermittent to allow for quick recovery;

(e) all cooling is to be direct exchange (DX);

(f) cooling requirements over 10 kW will be met by mixed-air (outside and return air) air handling units with DX coils and the capability of providing free cooling as the outside conditions allow;

(g) coat heating, cooling and condenser coils with a corrosion-resistant coating;

(h) cooling requirements of 10 kW and less may be met with ductless split air conditioners with a separate filtered and tempered outside air supply providing pressurization as required;

(i) provide air conditioning units with a seasonal energy efficiency ratio rating of 13 or better;

(j) provide air conditioning units with HFC R-410A refrigerant;

(k) locate the condensing unit near the direct expansion cooling coil (evaporator).

C.11.3.11 Design Builder shall provide piping that meets the following requirements:

(a) Velocities for hot water piping as follows:

(i) minimum: approximately 0.6 m/s;

(ii) average: approximately 1.5 m/s; and

(iii) maximum: approximately 2.4 m/s;

(b) maximum allowable pressure loss is 400 pa/m;

(c) minimum pipe size on hydronic piping is 20 millimetres;

(d) hydronic mains shall not be run in stairways or in egresses; and

(e) routing of hot water or glycol piping in tunnels shall not impede travel or material movement.

C.11.3.12 Design Builder shall comply with the following minimum requirements for hydronic piping appurtenances:

(a) use bladder-type expansion tanks on all closed-loop piping systems;

(b) locate expansion tanks on the suction side of the pump;

(c) install Y-type strainers with 40-mesh screens in all pump suction lines, and upstream of all critical control valves, and provide a manual blow-off valve;

(d) use globe-type valves for all modulating motorized control valves;

(e) install a balancing valve with each coil and terminal device;

(f) include a circuit balancer complete with pressure taps; and

(g) equip balancing valves, if used as a shut-off valve, with a memory device to return it to original balance point.

C.11.3.13 Design Builder shall meet the following requirements for snow melt systems:

(a) provide hydronic snow melting systems at the concrete aprons exterior to truck loading and unloading bays;

(b) provide a design verified by the system manufacturer for the required performance;

(c) provide propylene glycol charge for system;

(d) provide PEX tubing fabricated with an oxygen barrier, intended for a heating application and suitable for embedding in concrete;

(e) install the tubing according the manufacturer’s recommendations with no splices;

(f) install factory built supply and return manifolds complete with temperature gauges, valves, strainers, flow and temperature measurement ports;

(g) install supply and return manifolds in an accessible interior location; and

(h) provide a complete control system that will:

(i) automatically turn on the system to ice on the slab;

(ii) minimize slab temperature ramp-up times;

(iii) minimize thermal shock to the slab; and

(iv) integrate with the PCS. If vendor control package is supplied, plant PCS shall, at minimum, provide enable/disable functions and receive alarm outputs.

C.11.3.14 Design Builder shall comply with the following requirements for insulation:

(a) use Thermal Insulation Association of Canada best practices in executing all insulation assemblies unless exceeded by these documents;

(b) provide pre-insulated pipe supports to prevent thermal bridges on all insulated refrigerant lines;

(c) insulate and heat trace the following piping:

(i) exposed exterior piping containing liquid subject to freezing; and

(ii) buried piping that is installed within frost line;

(d) provide insulation types and thicknesses as prescribed in Appendix 18B – Specifications;

(e) provide recovery and jacket protection for pipe insulation exterior to the building or exposed to risk of mechanical damage as per Appendix 18B – Specifications;

(f) provide insulation on the following ducts:

(i) plenums and ducts carrying cooled and warm air for air conditioning applications;

(ii) return air ducts in ceiling plenums of air conditioned spaces;

(iii) ducts where moist air being carried by a duct could condense if the duct passes through cool spaces;

(iv) outside air intake ducts and ducts exposed to outdoors;

(v) exhaust ducts within 3.0 metres of exterior walls or openings;

(vi) boiler breeching, flue, and smoke pipe connections; and

(vii) ducts conveying air at temperatures above 37.7°C;

(g) provide insulation types and thicknesses as prescribed in Appendix 18B – Specifications;

(h) boiler breeching, flue, and smoke pipe: semi-rigid mineral fibre insulation with glass mat “K” value 0.035 W/m degrees°C maximum at 24°C; and

(i) generator exhaust system: Preformed Roxul Techton TM 1200 capable of withstanding up to 650°C complete with vapour barrier (metalized polyester reinforced with fiberglass yarn and Kraft paper).

C.11.3.15 Design Builder shall comply with the following minimum requirements for duct systems:

(a) route duct systems in a manner that facilitate proper support;

(b) arrange systems to provide access to dampers for maintenance and removal or replacement;

(c) use of flexible duct prohibited;

(d) do not use flexible duct to change direction;

(e) use round duct wherever possible;

(f) limit the duct aspect ratio to a maximum of 4:1 when using rectangular duct;

(g) minimize the number of fittings;

(h) include volume dampers at all branches from main trunks and at any other locations, as required for system balancing;

(i) use non-metallic flexible connections for all connections to equipment;

(j) include a minimum of three duct-diameters straight duct at fan inlets and outlets; where this is not possible, use an inlet box for fan inlets;

(k) provide a minimum radius-to-diameter ratio of 2.5 where elbows must be used at fan inlets;

(l) use elbows with a radius-to-diameter ratio of not less than 1.5 at other duct locations;

(m) provide turning vanes where space does not permit the specified ratio;

(n) locate ductwork to avoid obstructions or interference to plant staff;

(o) slope all horizontal exhaust ductwork that is subject to condensation to drain condensate;

(p) provide appropriate drainage at ductwork low points complete with trap to nearest drain;

(q) provide all low points of duct carrying moist air with 20 millimetres non-

metallic PVC drain valves or traps;

(r) hard pipe drain valves to a floor drain or sump;

(s) do not locate ductwork subject to condensation over electrical rooms or equipment;

(t) arrange ductwork to be accessible for cleaning;

(u) provide access doors for ductwork cleaning and device access as follows:

(i) at 10 metre intervals in all duct systems;

(ii) at the base of all duct risers;

(iii) at both sides of turning vanes in all ducts;

(iv) at each fire damper location;

(v) at each location of internally duct mounted equipment or devices; and

(vi) or as required such that dismantling the ductwork is not required for inspection and maintenance activities;

(v) provide ground and polished welded stainless steel joints in exposed locations;

(w) use sound traps or acoustical duct liner to minimize equipment noise in sensitive areas such as non-process areas;

(x) reinforce ducts to prevent pulsations and noise caused by duct pressure changes;

(y) use the equal friction or static regain method to size the duct;

(z) use duct roughness factors and fitting friction-loss coefficients in accordance with the ASHRAE handbooks, SMACNA guidelines or manufacturer's data, whichever is more stringent; and

(aa) use base friction-loss values for louvers, coils, and other equipment base on manufacturers' data.

C.11.3.16 When selecting construction materials for duct systems, Design Builder shall:

(a) design duct systems to withstand the maximum pressure (positive or negative) that may be imposed by any fan in the system by providing system pressure classification and duct construction in accordance with the following:

(i) latest edition of applicable SMACNA standards; and

(ii) national Bureau of Standards, PS 15-69;

(b) provide ductwork material per the requirements of the *WSTP Building Mechanical Guideline*;

C.11.3.17 Design Builder shall meet the following requirements for dampers and appurtenances:

(a) provide louvers, fire and balancing dampers, diffusers, grilles, and registers of the same material as the duct to which they are connected;

(b) provide control dampers that are AMCA-certified for air leakage and air performance;

(c) locate all operated dampers to be conveniently accessible from finished floor or an operating platform;

(d) provide all dampers with a position indicator visible from the operating level;

(e) provide all combustion air damper actuators in an engine generator room as “fail open” when the utility power is lost;

(f) interlock combustion air intake dampers and generators to open first before the generator starts;

(g) use parallel blade dampers for applications requiring two-position control and in air handling unit mixing boxes as required;

(h) use opposed blade dampers for applications requiring modulating control;

(i) provide any dampers that may be required to fully close as low leakage type with blade and jamb seals;

(j) provide fire dampers in the ductwork as required by code to maintain the fire separation rating;

(k) provide convergent transitions that slope 30 degrees and divergent transitions that slope 15 degrees;

(l) provide access doors at filters, heating and cooling coils, control components, and dampers to facilitate servicing;

(m) provide uniform air distribution at air inlets and outlets;

(n) locate air outlets above and as close to heat-producing equipment as possible, for heat removal from spaces;

(o) provide ventilation and exhaust from both high and low elevations where hazardous atmospheres may be present; and

(p) provide maximum air velocities through system components as per Table 11 or the manufacturer's recommendations if lower.

Table 10: Maximum Velocity for Dampers and Appurtenances

Component	Maximum Velocity
Heating coils	3 m/s
Cooling coils	2.5 m/s
Filters	2.5 m/s

C.11.3.18 Design Builder shall comply with the following minimum requirements for hangers and supports:

(a) design as required by SMACNA standards;

(b) provide adequate support to control movement, support the weight of the duct system and meet the seismic requirements;

(c) design hangers to permit freedom of movement of the duct system within the range of expansion forces expected;

(d) where connected to equipment, support the ductwork independently with no weight supported by the equipment and in such a manner that the equipment may be removed for service without the need for temporary support of the ductwork;

(e) support ducts at intervals required by the SMACNA construction methods and pressure class being used;

(f) provide a system in accordance with manufacturers' recommendations;

(g) place inserts in the forms for use with duct hangers in concrete construction;

(h) for structural steel, beam clamps of forged or cast construction may be used; the use of threaded inserts is prohibited;

(i) support vertical risers by angle iron attached transversely to the duct work; provide additional reinforcing at the point where the riser support attaches to the duct;

(j) support the coils independently by the structure and not by the duct system where coils are installed in ductwork; support the adjacent ducts independently to allow removal of the coil without the need for temporary support of the ducts;

(k) use materials that prevent corrosion caused by contact of dissimilar materials;

(l) use stainless steel fasteners and bolts for all hanger supports;

(m) all other hanger materials shall be designed for the environment in which they are located ie: stainless steel shall be used where H2S may be present;

(n) ensure that bracing, brackets, anchors and other assemblies used to brace the services and components against seismic loads are rated accordingly; and

(o) provide clearance between different services and between ceiling supports/hangers or ceiling members.

C.11.4 Control Requirements

C.11.4.1 Design Builder shall comply with the following requirements for the HVAC control systems:

(a) follow the requirements of the WSTP Building Mechanical Design Guideline and WWD Wastewater Treatment Facilities Automation Design Guide;

(b) building mechanical control shall be provided by the Infrastructure PCS;

(c) these control requirements shall be read in conjunction with and adhere to the requirements of Section C.13;

(d) the building mechanical controls to consist of the following:

(i) local controllers;

(ii) human machine interfaces;

(iii) field sensors and control components; and

(iv) operating, application and system specific software.

(e) the system is to be modular in nature and is to permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices;

(f) facilitate viewing and creation of various reports from the PCS including but not limited to alarm reports, energy consumption reports, equipment operating time and duration reports, and controller status reports;

(g) all wiring shall be installed in accordance with the WWD Electrical Design Guide and the *WWD Wastewater Treatment Facilities Automation Design Guide*;

(h) provide control devices and instrumentation of industrial grade and suitable for the area classification and environmental conditions;

(i) provide calibration ports/tees/tubing to allow calibration of instruments

without removing the instrument;

(j) locate all motor controls for fans and pumps in associated motor control centres (MCCs), with exception of 120 VAC, 1 phase motors in non-process areas, that will have a combination starter mounted locally complete with HOA or HOR switch, as required by the *WWD Wastewater Treatment Facilities Automation Design Guide*; and

(k) provide all circulation pumps with an HOR switch in accordance with the *WWD Wastewater Treatment Facilities Automation Design Guide*.

C.11.4.2 Design Builder shall provide a control system that meets the following requirements for alarms:

(a) Monitoring and alarming functions for process areas, chemical rooms, electrical rooms, mechanical rooms, plant staff areas and others spaces as required by Good Industry Practice and Appendix 18D – City Standards shall include:

(i) real time monitoring of room temperatures;

(ii) high space temperature;

(iii) high supply air temperature;

(iv) low space temperature;

(v) low supply air temperature;

(vi) hydrogen sulphide gas alarm;

(vii) combustible gas alarm;

(viii) CO gas alarm;

(ix) NO_x gas alarm;

(x) Ambient pressure; and

(xi) As required to meet NFPA 496 pressurization applications when this standard is applied.

(b) monitoring and alarming functions for fans, makeup air units and air handling units shall include:

(i) filter pressure drops;

(ii) outside air temperature;

(iii) damper positions;

(iv) coil valve positions;

(v) VFD speed;

(vi) start / stop status;

(vii) supply air temperature;

(viii) airflow;

(ix) motor status; and

(x) freeze protection for each coil receiving outside air.

C.11.4.3 Design Builder shall meet the following requirements for identification:

(a) identify all piping and ducting by commodity, flow direction and hazard using the colours and format specified in Appendix 18D – City Standards; and

(b) all control wiring, controllers and devices are to be identified and tagged per the *WWD Wastewater Treatment Facilities Automation Design Guide*;

C.11.5 Design Criteria for Plumbing and Fire Protection

C.11.5.1 Design Builder shall:

(a) provide all structures that will be occupied or used for process with an adequate supply of safe, potable hot and cold water, that will be protected from backflow, backpressure, or back-siphoning from non-potable or contaminated sources and meet the requirements of the Manitoba and National Plumbing Code;

(b) provide drainage systems that are designed in accordance with or exceed as need the requirements of the Manitoba and National Plumbing Codes to provide a safe and fully functional system; and

(c) meet the requirements of the *WSTP Building Mechanical Design Guideline* Plumbing Systems section.

C.11.5.2 Calculation and Design Submittals

C.11.5.2.1 Design Builder shall meet the following requirements for riser diagrams:

(a) show riser diagrams as isometric drawings;

(b) provide separate riser diagrams for the following items:

(i) sanitary drains and vents;

(ii) acid waste drain and vent piping system;

(iii) domestic hot water supply, domestic hot water return, domestic tempered water and potable cold water;

(iv) fire standpipe;

(v) automatic sprinklers;

(vi) storm drain;

(vii) natural gas;

(viii) diesel fuel supply, diesel fuel return, diesel fuel vent;

(ix) compressed air; and

(x) special piping systems that require risers for clarity.

(d) show schematically all fixtures, drains, and other appurtenances requiring plumbing, together with required utility connections on the riser diagram. the schematic will include, where applicable: clean-outs, water hammer arrestors, vents through roof, trap primers, valves, backflow preventers, pumps, and expansion loops; and

(e) indicate all pipe sizes in millimetres.

C.11.5.3 Design Builder shall submit calculations on request for all systems and equipment including sanitary, cold water, hot water, hot water recirculating, compressed air, natural gas and diesel fuel, water heaters, air compressors, sump pumps, sewage ejectors, circulating pumps, fire pumps, jockey pumps, booster pumps, and pressure regulating and temperature regulating valves.

C.11.5.4 Site Planning Requirements

C.11.5.4.1 Design Builder shall:

(a) determine the appropriate size and number of potable and non-potable water service connections for domestic loads, make-up water for hydronic systems, and fire protection;

(b) locate building service water connections and water meters and coordinate load requirements with the utility supplier; and

(c) coordinate the installation of natural gas lines and load requirements with the gas provider and terminate with the gas meter and pressure reducer station at the exterior wall of each building.

C.11.5.5 Plumbing Design Requirements

C.11.5.5.1 Design Builder shall:

(a) meet the requirements of the *WSTP Building Mechanical Design Guideline*;

(b) use unions or flanges for connection to equipment;

(c) make provisions for thermal expansion and flexibility in piping systems;

(d) in areas having hung ceilings, install all piping above the hung ceilings and install insulation and appropriate systems to prevent condensation or other liquid damage to ceiling tiles;

(e) provide sleeves with mechanical elastomeric seals and stainless steel hardware (link seals) for pipe penetrations through exterior walls and floors below grade, for floor slabs on grade, or for watertight non-fire rated penetrations;

(f) seal both ends of penetrations through fire rated assemblies to maintain fire resistive integrity with Underwriters' Laboratories of Canada; listed fill, void, or cavity material for fire-rated barriers;

(g) provide gastight seals where required, including through barriers separating classified and unclassified areas; include a minimum 50 millimetre high waterstop annular ring for sleeves in floor slabs and below grade exterior walls;

(h) use wall mounted plumbing fixtures;

(i) conform piping connections into piping systems of different service ratings to the specifications of the higher service rating up to and including the first isolation valve;

(j) do not apply vertical or horizontal loads to the equipment as a result of the layout and support system;

(k) provide gas-tight seals where required;

(l) do not run piping through electrical rooms, control rooms, automation rooms, MCC rooms or above any electrical equipment, motors, or motor control centers;

(m) use pre-insulated conduit type system for buried piping systems;

(n) use expansion loops and not expansion joints;

(o) provide bypass piping with manual globe valves for all pressure regulating valves; and

(p) locate all operated valves, instruments, or other equipment such that it is conveniently accessible from grade, finished floor, or operating platform.

C.11.5.6 To meet the requirements for plumbing and fire protection system, Design Builder shall:

(a) construct all floor gratings and drains of materials suitable to resist corrosion from chemicals likely to be in the area;

(b) equip floor penetrations with a concrete curb or stainless steel sleeve at least 200 millimetres high to prevent liquid on the floor from running down the floor penetration;

(c) provide securely-mounted equipment guards for couplings, belts, chain drives, extended shafts, and exposed moving parts;

(d) if control valves or instruments have bypass lines to allow removal of device, equip the main line with isolation valves so as to allow the unit to be removed while maintaining service. The connection from each isolation valve to the bypass line shall be flanged to allow removal of the bypass section;

(e) equip all liquid cooling lines with a visible means to easily confirm flow;

(f) provide all underground piping with clean out connections;

(g) route all piping to avoid interference with the removal or service of equipment;

(h) provide a valve within 300 millimetres of the branch connection to allow isolation of the branch for all pressurized piping branches from supply headers;

(i) provide sump pumping stations in all below grade areas;

(j) sump pump stations are to have a duplex pumping arrangement with automatic alternating and emergency change-over controls;

(k) locate sumps and pumps to allow for convenient maintenance of both sump and pumps;

(l) locate manual valves such that dead legs are minimized; and

(m) provide manual air relief on dead legs in the pipelines and pipe the air release to the nearest drain.

C.11.5.7 Design Builder shall provide all plumbing systems including:

(a) domestic water hot, cold, and recirculation;

(b) non-potable water;

(c) fire protection supply;

(d) water for plumbing fixtures;

(e) sanitary waste and vent;

(f) roof drainage;

(g) acid waste and vent;

(h) floor drains;

(i) condensate drainage (including cooling coils and air handling units);

(j) oil, grease and grit interceptors;

(k) plumbing fixtures;

(l) natural gas;

(m) diesel fuel storage;

(n) diesel fuel piping; and

(o) compressed air.

C.11.5.8 Design Builder shall comply with the following minimum requirements for domestic water systems:

(a) provide pressure regulators for water service pressures exceeding 415 kPa as follows:

(i) provide two parallel regulators, one with a capacity of approximately two-thirds of the total peak flow, the other regulator for one-third of the total peak flow; and

(ii) the larger unit to be adjusted for a lock-up pressure of 70 kPa below the setting for the smaller unit thus ensuring that only the smaller regulator will function during periods of low demand;

(b) install water hammer arrestors complete with isolation valves where quick closing valves are used including plumbing fixture flush valves;

(c) the domestic hot water may be generated by instant electric or gas heaters (for flows up to or less than 0.1 L/s electric heaters may be used

and for flows up to or less than 0.3 L/s gas heaters may be used), storage tanks with double wall hot water-to-domestic hot water heat exchangers where boiler hot water service will be available year-round or natural gas fired water heaters;

(d) provide circulation pumps to eliminate hot water service delays at remote locations;

(e) equip recirculation piping with a thermostat to control the pump for long sections; and

(f) provide emergency eyewash stations, emergency showers and drench hoses complete with thermostatic mixing valves to deliver tepid water (21°C) for flow and duration specified in SDS and American National Standards Institute (ANSI) Standard Z358.1 – Emergency Eyewash and Shower Equipment.

C.11.5.9 Design Builder shall comply with the following minimum requirements for sanitary drains, acid waste and vent systems:

(a) protect all sewer drainage systems against backflow;

(b) discharge all sanitary drainage in accordance with Section C.10.7.10 and Section C.10.7.11;

(c) provide floor catch basins and drains in all pump rooms and process equipment areas where water could be present;

(d) provide gutters at all process areas subject to frequent washdowns or expected heavy spillage, exterior walls below grade and at all wet well and tank walls;

(e) provide duplex sump pumps or duplex sewage ejectors, as appropriate, for all drainage piping that cannot be connected to a sanitary sewer by gravity;

(f) provide duplex sump pumps for inflows that are constant including drains from pump seal water systems, automatic strainer backwash, and analyzers;

(g) provide sump pump discharge piping with a check valve and isolation valve; locate the valves in the horizontal and as close to the pump discharge as possible; locate the isolation valve after the check valve; provide a lever and weights or springs for check valves 75 millimetres and larger;

(h) provide oil separators in areas where oil leakage may contaminate the floor drainage system;

(i) isolate areas with chemical equipment from other areas by curbs; slope floor of the curbed areas to chemical-resistant sump pump installations

dedicated to the curbed areas; make provisions for pump discharge into trucks in case of tank failure; do not provide floor drains within diked areas; and

(j) provide an independent acid waste drainage and venting system in areas where corrosive wastes outside of the range of pH 6.0 to 9.0 will be handled.

C.11.5.10 Design Builder shall meet the following requirements for roof drainage:

(a) size drainage piping to accommodate storm flows and roof configurations set out in the Canadian and Manitoba Plumbing Code;

(b) any discharges to grade shall not cause a safety hazard;

(c) discharge drainage into the dedicated site land drainage system;

(d) separate interior roof drain piping from the sanitary system inside the building;

(e) insulate roof drain piping;

(f) protect all storm drainage systems against the possibility of backflow; and

(g) locate all drainage piping on the interior of buildings.

C.11.5.11 Design Builder shall meet the following requirements for floor drains:

(a) use weeping flanges with waterproofing membrane on floor drains located in waterproof floors above grade; and

(b) locate floor drains in upper rooms so that drainage piping passing through lower rooms will not be above chemical tanks or electrical equipment.

C.11.5.12 Design Builder shall connect condensate drainage from cooling coils, air handler and make-up air intake plenums and heat recovery units to the plant drainage system.

C.11.5.13 Design Builder shall comply with the following minimum requirements for plumbing interceptors:

(a) provide plumbing interceptor sumps in storm and sanitary drainage systems for the purpose of intercepting solids, sand, grease and oil in loading bays, areas with regular vehicular traffic and as required by code.

C.11.5.14 Design Builder shall comply with the requirements for plumbing fixtures found in Appendix 18B – Specifications.

C.11.5.15 Design Builder shall comply with the following requirements for safety fixtures, at a minimum:

(a) provide plumbed type eyewash and emergency shower stations in accordance with ANSI Z358.1 at all locations where chemicals are stored or handled and have SDS requiring emergency wash equipment;

(b) provide plumbed type eyewash and emergency shower stations in accordance with ANSI Z358.1 at all locations where process components or by-products create a potential injury or health danger;

(c) provide dust covers on all eyewash units;

(d) provide frost proof units for all exterior installations and installations within un-heated building enclosures that do not depend on electric heat tracing and include independent frost-proof shower and eyewash valves;

(e) mount exterior units adjacent to heated buildings with valve operator extensions from heated spaces for freeze protection such that valves may be operated from the exterior location of the unit;

(f) Equip all units with a flow/switch alarm that sends a signal to the PCS for remote safety alarm indication and a local strobe/horn alarm unit for exterior units only, unless otherwise specified;

(g) provide 21°C tempered water for all deluge showers and eyewash fountains; and

(h) provide a tempered water recirculating system for all systems to insure fast delivery of tempered water.

C.11.5.16 Design Builder shall comply with the following minimum requirements for the natural gas system:

(a) provide pressure regulators at locations to supply gas at lower pressure (as required) to equipment at points of use;

(b) do not run natural gas piping within enclosed spaces except the last leg from outside the building to the equipment; and

(c) design in accordance with the CSA B149 gas code tables.

C.11.5.17 Design Builder shall submit a fire protection study in accordance with Schedule 5 – Review Procedure and Appendix 18K – Special Studies and Models.

C.11.5.18 Design Builder shall comply with the following minimum requirements for standpipes:

(a) if required, provide standpipes according to the requirements of the Manitoba Fire Code and NFPA 14;

(b) in non-process areas, provide a minimum of Class II Standpipe;

(c) in process areas, provide a minimum of Class III Standpipe; and

(d) confirm classes with the authority having jurisdiction.

C.11.5.19 Design Builder shall comply with the following minimum requirements for sprinklers:

(a) if required, provide standpipes according to the requirements of the Manitoba Fire Code and NFPA 13;

(b) provide dry sprinkler systems in areas subject to freezing temperature;

(c) provide dry sprinkler systems in electrical rooms, automation storage room, and file storage room; and

(d) protect sprinkler heads against mechanical damage and injury.

C.11.5.20 Design Builder shall comply with the following minimum requirements for fire extinguishers:

(a) provide portable fire extinguishers of the proper classifications and size throughout the Infrastructure in accordance with NFPA 10; and

(b) provide clear PVC cabinets in corrosive areas.

C.11.5.21 Design Builder shall provide gas detection systems:

(a) that meet the requirements of the WSTP Building Mechanical Design Guideline;

(b) for combustible gases, hydrogen sulphide, CO, NOx and if required O_2;

(c) with local and remote alarming through the PCS;

(d) with interlocks for ventilation purge or shutdown as required;

(e) with combustible gas detection in locations stipulated by NFPA 820;

(f) with hydrogen sulphide detection in locations of potential gas collection; and

(g) with CO and NOx detection at interior spaces subject to regular vehicular or forklift traffic.

C.11.5.22 Design Builder shall comply with the following requirements for exterior fuel storage:

(a) follow the requirements of CSA B139 – Installation Code for Oil Burning equipment and NFPA 37 – Standard for Installation and Use of Stationary

Combustion Engines and Gas Turbines as required;

(b) provide double-wall tanks, with interstitial space and integral leak-detection and monitoring system;

(c) locate the tanks so that the truck or transport making the product delivery does not need to back up in order complete the delivery;

(d) locate the delivery area and provide all necessary systems to facilitate the complete transfer of fuel from the delivery truck to the fuel storage tanks;

(e) locate tanks so they are not in contact with or embedded in concrete;

(f) locate tanks an adequate distance from adjacent structures that might impose loads on the walls; and

C.11.5.23 Design Builder shall comply with the following requirements for fuel pumping:

(a) provide a duplex (duty-standby) fuel transfer pump system complete with all controls, pressure reliefs and flow monitoring;

(b) provide a system that is simple to maintain;

(c) provide all supply, return, overflow and vent piping;

(d) provide dedicated dual wall day tanks for each generator;

(e) do not run fuel piping within enclosed spaces except the last leg from outside the building to equipment;

(f) all underground piping is to be dual wall containment connecting to below grade transition sumps with leak detection before routing above grade;

(g) provide strainers, check valves, swing joints, flexible connectors, fill connections, drain connections, sounding line, and adapters, as required for proper system operation;

(h) provide a fuel cooler system as required;

(i) provide corrosion protection for the piping system; and

(j) provide storage tank fuel level monitoring and leak detection systems for tanks and underground piping systems and equip with relays to transmit alarm signals to the PCS.

C.12 Electrical

C.12.1 Codes and Standards

C.12.1.1 Design Builder shall design and construct the electrical systems in compliance with the following documents and the codes, standards and City Standards referenced therein:

(a) WWD Electrical Design Guide;

(b) WWD Sewage Treatment Plant Tag Naming Standard; and

(c) WSTP Document Numbering Standard.

C.12.1.2 All electrical equipment shall be CSA or cUL approved and all electrical system design shall be in accordance with applicable CSA standards.

C.12.1.3 Lighting systems shall comply with Canadian Occupational Health and Safety (SOR/86-204) – Part VI Lighting.

C.12.1.4 Exceptions to the WWD Electrical Design Guide

C.12.1.4.1 Table 11 is a list of exceptions and clarifications to the WWD Electrical Design Guide as it pertains to the Project.

Table 11: Exceptions to the WWD Electrical Design Guide

Section	Exception or Direction
3.4.1 Redundancy Requirements, Wastewater Treatment Facilities	Clarification: A fault on the bus of a switchgear or motor control centre busbar may impair the operation of the wastewater treatment facility. It shall be possible to isolate the faulted section and operate the non-faulted section of the switchgear or motor control centre, which may include use of the main-tie-main arrangement. The intent is that a minimum of 50 percent of the building services and process systems will remain available for any point of failure of electrical equipment.
6.15.1 Variable Frequency Drives, Table 6-8.	Add Note 5. VFD carrier frequencies shall be set to 2.5-3 kHz.
15.3 Application Requirements and Configurations, Table 15-1	In this Wastewater Treatment Facility application, the method of power factor and harmonic correction for loads 600 V and less is to be decentralized bulk correction via active harmonic filter banks.

C.12.2 Objective

C.12.2.1 The headworks electrical design shall enable the headworks process mechanical and building mechanical aspects of the Infrastructure to function as intended.

C.12.2.2 Electrical systems shall be provided for the purpose of allowing buildings to be safely occupied and systems to be operated and maintained satisfactorily.

C.12.3 NEWPCC Power Supply Upgrade Project

C.12.3.1 Design Builder shall provide all works including but not limited to protection equipment and systems, feeders, feeder terminations, communication and automation for power management and control functionality, calculations and studies and coordination required to interface the Project with the works of the NEWPCC Power Supply Upgrade Project and provide a complete, functional, seamless end product.

C.12.3.2 Design Builder is responsible to coordinate and cooperate with NEWPCC Power Supply Upgrade Project contractor via the City Representative and Appendix 18P – Coordination Protocol.

C.12.3.3 Design Builder shall provide the City with all documentation needed for coordination with Manitoba Hydro for review prior to submission by Design Builder to Manitoba Hydro. Submit information as requested by the City for MB Hydro's review. Documentation required shall include the typical loading and calculations required by Manitoba Hydro for increases of power usage within the service agreement.

C.12.3.4 Design Builder to coordinate and arrange temporary works with the City and utilities.

C.12.4 Electrical Distribution System Configuration

C.12.4.1 System Configuration J (WWD Electrical Design Guide) is an acceptable system configuration, with the following clarifications:

(a) the headworks electrical system shall be configured in a two-bank configuration at all voltage levels, with processes and loads distributed as evenly as practical between the two banks;

(b) electrical distribution equipment shall have N+1 configuration, which means that redundant components shall be sized to carry additional loading if one item fails;

(c) connect equipment to the redundant power supply sources in a manner to minimize impact to the process and facility in the event of an outage of any single piece of distribution equipment;

(d) the intent is that a minimum of 50 percent of the total process capacity shall be available with any one piece of equipment, including busbars, out of service;

(e) for instruments and devices that are not physically redundant, system redundancy shall be provided such that loss of a single cable or device will not disable the process because operation will revert to the alternate device(s) or alternate system(s);

(f) the headworks electrical system shall receive two 12.47kV feeders from the Area E electrical building, from existing circuit breakers. Each feeder shall serve a separate 12.47 / 4.16 kV outdoor transformer and neutral grounding resistor. The two transformers and neutral grounding resistors shall be installed outside of the headworks building in a secured compound;

(g) the secondary of each transformer shall terminate at a circuit breaker of one 4.16 kV switchgear bank within the headworks electrical room;

(h) the two-banks of headworks switchgear shall be interconnected by tie breakers at each voltage level;

(i) the intent is that tie breakers will normally all operate open, and each bank be fed from its respective step-down transformer. Both banks can be supplied from a single transformer, should it be required;

(j) the 4.16 kV switchgear installed under this DBA shall include breakers to serve the number of feeders required under this DBA, with one additional equipped spare. It shall be possible for addition of two circuit breaker cells to each bank in future, without expansion of the electrical rooms;

(k) the headworks facility shall utilize 4.16 kV MCCs for motors equal or greater than 350 horsepower. The 4.16 kV bus shall be fed from 4.16 kV switchgear in a two-bank configuration;

(l) provide two-bank 600V and 120/208V electrical distribution systems in the headworks building;

(m) redundant dry type 4.16kV-600V transformers shall provide 600V power from the headworks building 4.16kV switchgear. Transformers rated 1000 kVA or higher shall utilize high resistance neutral grounding resistors;

(n) provide two banks of 600V switchgear and MCCs to serve Headworks 600V systems;

(o) redundant dry type 600V – 120/208V transformers shall provide 120/208V power from the headworks building 600V switchgear;

(p) provide two banks of 208V switchgear and MCCs to serve Headworks 208V systems; and

(q) standby power generation shall be connected at 12.47 kV per Schedule 18 Appendix A, rather than 4.16 kV.

C.12.5 Electrical Design Requirements

C.12.5.1 Design Builder shall include all equipment and systems as necessary for a full and functioning system for the headworks and standby power generation facilities, including:

(a) climate-controlled electrical rooms to accommodate electrical and associated equipment;

■ MV and LV switchgear, MCCs, and panelboards;

■ motor starters and variable frequency drives;

(d) standby generators, transfer systems, and associated equipment;

(e) transformers, neutral-grounding resistors;

(f) cabling, ductbanks and raceways;

(g) wiring devices, junction boxes, protection and control systems;

(h) load shedding and power management equipment;

(i) fire alarming and suppression;

(j) lighting systems;

(k) uninterruptible power supplies;

(l) harmonic filtering and power factor correction;

(m) grounding and lightning protection; and

(n) telephone and CCTV systems.

C.12.5.2 The standby power generation system shall provide standby power to the NEPWCC loads in accordance with Appendix 18A – Process Functional Requirements and Appendix 18M – Classification of Loads.

C.12.5.3 Electrical systems shall interconnect with existing facilities as outlined herein.

C.12.5.4 Design Builder shall provide the following spare capacity, at minimum:

(a) 20 percent space for circuit breakers within 600V MCCs and LV panelboards. Provide spare circuit breakers in appropriate quantity and rating based on the most common circuit breaker used. Show spares on design drawings and schedules.

C.12.6 Equipment Requirements

C.12.6.1 Voltage Levels

C.12.6.1.1 System voltage levels shall be as specified in the *WWD Electrical Design Guide*, or as otherwise stated herein.

C.12.6.1.2 Nominal system voltages and equipment utilization voltages shall be in accordance with ANSI C84.1 range A as applicable for each voltage level.

C.12.6.1.3 The nominal operating frequency is 60 Hz, ±10 %.

C.12.6.1.4 There shall be less than 4% voltage drop from point of connection at the electrical building 12.47kV circuit breaker to the point of utilization at the headworks and generator facilities.

(a) This includes where the entire systems are operating using a single feeder and transformer at each voltage level, with tie breakers closed, and systems operating at peak design flow rate or maximum generation capacity.

C.12.6.1.5 No single feeder or branch circuit shall exceed 3% voltage drop, or as otherwise required by codes and City standards.

C.12.6.1.6 Feeders to switchgear, MCCs, transformers and panel boards shall be sized for maximum voltage drop of 1%.

C.12.6.1.7 The minimum voltage on switchgear and MCC bus bars during start-up of the electrical motors shall be 95 % of the rated voltage when a motor is operating at 115% of its full-load current rating.

C.12.6.1.8 During starting or re-acceleration of motors, the voltage at motor terminals shall be at least 85 percent of the equipment voltage (90% if controlled by VFD), but not more than 110 percent of rated equipment voltage.

C.12.7 Electrical Room Requirements

C.12.7.1 As far as practicable, all electrical, instrumentation and controls equipment shall be installed within an electrical room. Electrical rooms shall be arranged to meet the City operations and maintenance criteria and space for future expansion.

C.12.7.2 Door selection (door heights, door widths, removable mullions or panels, etc.) shall suit the removal and replacement of equipment.

C.12.7.3 Access paths and doors shall be provided into each electrical room with adequate clearances to allow equipment installation and removal in upright position, and without dismantling it into smaller parts.

(a) Egress doors shall open to the outside of the electrical room and shall be equipped with “panic hardware”;

(b) Electrical room doors shall be provided with security means to prevent unauthorized access;

C.12.7.4 Electrical rooms shall not be located below grade.

C.12.7.5 Adequate aisle space shall be provided to remove equipment in the future.

C.12.7.6 Electrical rooms shall not be used as pathways to access other areas of the building.

C.12.7.7 Electrical rooms shall not have roof penetrations to the outside.

C.12.7.8 Equipment is provided with housekeeping pads per the *WWD Electrical Design Guide*.

C.12.7.9 Electrical rooms shall be adequately conditioned to dissipate heat generated by the electrical equipment. Worst case heat dissipation from electrical equipment shall be considered for summer and winter conditions.

C.12.8 Uninterruptible Power Supplies

C.12.8.1 Each building or area containing process equipment shall have centralized large UPS systems.

C.12.8.2 Design Builder shall provide UPS units for loads including:

(c) all PLC controls, including switchgear PLC(s) and associated components;

(d) power control and monitoring system;

(e) all computers, workstations and servers;

(f) all networking components;

(g) the public address (PA) system;

(h) security and CCTV systems; and

(i) other systems as appropriate.

C.12.8.3 Design Builder shall provide UPS backed orange duplex 15 A receptacles as specified in the Technical Requirements.

C.12.9 DC Power Supplies

C.12.9.1 Design Builder shall provide a battery system that allows for testing of the battery system by the maintenance team without interruption of the 125 VDC supply for medium voltage switchgear, sized per the *WWD Electrical Design Guide*.

C.12.9.2 The DC power supplies shall include:

(a) 125 VDC for medium voltage switchgear;

(b) ungrounded 24 VDC for communication systems; and

(c) grounded (negative side) DC power supplies 24 VDC for instrumentation systems and 24 VDC control panels.

C.12.9.3 DC power systems shall be redundant, with the following additional requirements:

(a) batteries shall be sized to accommodate loads for 24 hours; and

(b) batteries shall be sized to accommodate two operations for all momentary loads.

C.12.10 Harmonic Filtering and Power Factor Correction

C.12.10.1 Coordinate with the power study required in Appendix 18K – Special Studies.

C.12.10.2 Power factor and harmonics at 600 V and below shall be addressed with decentralized automatic harmonic filter and power factor correction equipment.

C.12.10.3 The furthest upstream points of supply at each voltage level are to be taken as the notional point of common coupling for harmonic and power factor correction.

C.12.10.4 Where there is a two-bank low voltage distribution configuration, harmonics and power factor correction are to be provided for each bank.

C.12.10.5 Correction equipment serving one bank does not have to be sized to serve the full system with the tie breakers closed and other bank correction out of service.

C.12.10.6 Each active harmonic filter and power factor correction unit shall be sized to meet all given harmonic and power factor performance requirements and shall have capacity to accommodate 10% future additional load.

C.12.10.7 It shall be possible to increase the active harmonic filters capacity by modular expansion of the active harmonic filters, or by connecting additional active harmonic filters, and wiring their controls together to act seamlessly.

C.12.11 Transformers

C.12.11.1 Outdoor Transformers

C.12.11.1.1 Design Builder shall provide transformers per the following:

(a) provide concrete vaults. Arrange vaults and duct banks such that they will not experience differential settlement or heaving; and

(b) where redundant medium voltage transformers are within 10 m of each other, provide two-hour fire-rated blast walls between the

transformers, and extend height of blast walls to 1 metre above top of transformer.

C.12.11.1.2 Design suitable grounding and fence around the transformers.

C.12.11.1.3 Consider environmental, safety, and equipment protection (e.g. vehicular traffic etc.) requirements related to distribution transformers in hazard identification and risk analysis (HIRA) and HAZOP.

C.12.11.1.4 Review transformer inrush currents with generator system capabilities. It shall be possible to:

(a) start one generator, with all MV transformers offline, energize the system from standby power, and automatically connect the MV transformers one at a time; and

(b) switch any transformer on or off while operating on a single generator, in any sequence, without causing objectionable generator voltage or frequency transients.

C.12.11.2 Low Voltage Distribution Transformers

C.12.11.2.1 Design Builder shall provide separate transformers and distribution panels for different types of loads (i.e. lighting and receptacle loads shall be separated from process equipment loads).

C.12.12 Low Voltage 600V Switchgear

C.12.12.1 Design Builder shall provide low voltage switchgear with circuit breakers. Fused switches are not permitted.

C.12.13 Power Management Control and Load Transfer Systems

[redacted]

[redacted]

C.12.14 Protection Relays

C.12.14.1 Microprocessor-based multifunction protection relays shall have power management and control functions with communication based on IEC-61850 (Ethernet);

C.12.15 Cable Tray

C.12.15.1 In its design and construction of cable trays, Design Builder shall:

(a) refer to the Corrosion Study in Appendix 18K for additional information and requirements.

[redacted] allow spare capacity for each cable tray to support the weight required to meet the more stringent of:

(i) an additional 25 percent of the number of cables; or

(ii) an additional 25 percent of the total weight of the cables in the cable tray (assume the tray is 75 percent loaded with 25 percent spare capacity);

C.12.16 Life Safety

C.12.16.1 Design Builder shall meet all life safety requirements.

C.12.16.2 No life safety system or other system for which emergency power is required shall rely upon the standby generator system for emergency power.

C.12.17 Motors

C.12.17.1 Use of two speed motors shall be limited to motors less than 0.746 kW and limited to HVAC functions. Where two-speed motors are used, provide motors with dual windings.

C.12.18 Grounding and Lightning Protection

C.12.18.1 Design Builder shall provide a grounding system and equipment and lightning protection. Provide studies in accordance with Appendix 18K – Special Studies and Models.

C.12.18.2 Design and installation shall meet the following:

(a) NFPA 780 Standard for the Installation of Lightning Protection Systems;

(b) CAN/CSA B72 Installation Code for Lightning Protection Systems; and

(c) provide lightning protection for any structure, building, or area where an explosive atmosphere is likely to occur during normal operation or a Zone 0, Zone 1, Zone 20, or Zone 21 hazardous location; and the Main Control Room.

C.12.18.3 Design Builder shall coordinate with equipment manufacturers to ensure the electrical equipment complies with the grounding and power study requirements.

C.12.18.3.1 Provide bonding and grounding, and surge and lightning protection for electrical equipment, power systems, automation and electronics systems. Systems shall be separate to a large degree but ultimately interconnected as per relevant code and *WWD Electrical Design Guide*.

C.12.18.3.2 Electrical rooms shall have standalone ground bus bars wall mounted in accessible locations for each bank. One ground bus bar shall be the single point of common connection between the safety grounding system, instrumentation grounding system, and other grounding and bonding methods as described in the ground model in Appendix 18K – Special Studies and Models;

C.12.19 Power Conditioners

C.12.19.1 Design Builder shall provide a power conditioners / filters to be used to protect sensitive electronic equipment, including control system processors and HMIs, DC power supplies, and signal converters, in addition to protection provided by a UPS.

C.12.20 Lighting

C.12.20.1 Provide lighting suitable for task performance, visual comfort, entry and egress, lighting control, energy efficiency, aesthetics, and to minimize maintenance cost and effort.

C.12.20.2 Design Builder shall design the lighting system to comply with National Energy Code for Buildings, and the *WWD Electrical Design Guide*.

C.12.20.3 Design Builder shall prepare a lighting design model in accordance with Appendix 18K – Special Studies and Models.

C.12.20.4 In process and service areas where it could be unsafe for lighting to turn off unexpectedly or repeatedly attempt to turn off, implement a lighting control strategy that balances energy conservation with plant staff safety.

C.12.20.5 Design Builder shall provide emergency illumination in accordance with the *WWD Electrical Design Guide*.

C.12.20.6 Battery systems shall be provided for emergency lighting, exit signs, fire alarm system, and life safety system. These systems shall be sized for a minimum of 30 minutes to allow transfer to the standby power generator system;

C.12.21 Electrical Signage

C.12.21.1 Design Builder shall provide all electrical signs in accordance with the City requirements. Locate signs indicating electrical dangers, highest voltage present and warnings or information at the following locations at a minimum:

(a) on doors and fence locations of 12.47 kV, and 4.16 kV switchgear or other similar compartments where exposed, energized electrical parts are located;

(b) on doors of electrical rooms;

(c) on medium voltage cable tray, trough or bus duct;

(d) on transmission, distribution and barrier structures where affected persons or the public may be present;

(e) for all electrical equipment in all electrical rooms, provide information signs (labels) with arc flash levels and boundaries indicated that meet CSA Z462 requirements; and

(f) wall mount permanent framed copies of power distribution and local distribution (downstream) single line diagrams in all electrical rooms.

C.12.22 Post-Disaster Requirements

C.12.22.1 All electrical equipment required to provide essential services shall be designed and installed to meet or surpass post disaster requirements.

C.12.23 Site Planning Requirements

C.12.23.1 Design Builder shall follow the WWD Electrical Design Guide for layout of electrical equipment.

C.12.23.2 Hazardous Location Classification

C.12.23.2.1 Design Builder shall meet the minimum electrical equipment requirements for the hazardous area classification as defined in CSA C22.1 and NFPA 820. Where NFPA 820 has more stringent requirements above those minimum requirements provided in CSA 22.1, or vice versa the more stringent shall apply.

C.12.23.3 Environmental Conditions

C.12.23.3.1 Electrical equipment shall be installed in a manner approved by the manufacturers and in accordance with environmental conditions.

C.12.23.3.2 Design Builder shall ensure the equipment is suited for the environmental conditions, and shall consider summer and winter conditions to ensure components/devices are used within their operating range and the following:

(a) in areas with sprinklers, provide equipment with suitable construction and CSA/NEMA rating;

(b) in outdoor locations, all works shall be suitable for climate extremes including extreme winds, direct sunlight, and shall be suitable for long term exposure to UV and atmospheric pollutants;

(c) with the exception of liquid filled transformers and associated NGRs, underground ductbanks and raceways, lighting and convenience receptacles, electrical equipment shall not be installed outdoors;

(d) consider environmental as well as hazardous location requirements. In process areas that are hazardous, there is generally also a wet and corrosive environment and the installation must be suitable for all of these conditions;

(e) specify and clarify the hazardous location wiring methods in alignment with relevant codes. Proper seals and barriers, and CSA approved wiring methods shall be employed; and

(f) be suitable for washdown in any process or shop areas subject to splashing or long term collection of dust or dirt due to exposure to a contaminant not generally present in other areas.

C.12.23.4 Corrosion Protection

C.12.23.4.1 Design Builder shall provide cathodic, impressed current, or other protection systems required based on the corrosion study and/or other process requirements. Coordinate with corrosion study in Appendix 18K – Special Studies and Models.

C.12.23.4.2 Electrical systems shall use materials that resist corrosion, that resist or

prevent corrosion caused by contact of dissimilar materials, and that are suitable for the area classification.

C.12.23.5 Areas with Hydrogen Sulfide or Other Gases are Present

C.12.23.5.1 Design Builder shall not install electrical equipment in areas where hydrogen sulphide is present, except if Design Builder can demonstrate to the City that there is no practical alternative through the submission of a RFS. Materials and methods in such locations shall be immune to the effects of hydrogen sulphide and listed or confirmed as suitable for the environment by the manufacturer. Gaskets, seals, and other elements of the protection against corrosion shall be of a permanent, robust nature expected to last the normal lifetime of the equipment under protection.

C.12.23.5.2 Design Builder shall coordinate materials and methods for any electrical installations performed in hazardous locations with the corrosion study in Appendix 18K – Special Studies and Models.

C.12.23.6 Below Grade Chambers

C.12.23.6.1 Avoid the installation of electrical equipment in chambers below grade (such as a valve chamber or metering chamber) to the extent possible. Only motors or sensors shall be installed in below grade chambers. These motors and sensors shall be rated for their environment in addition to the materials and methods required for hazardous locations. Where below grade equipment is necessary:

(a) install equipment in easily accessible locations;

(b) use CSA 4X/6P enclosures, or hazardous rated for the environment;

(c) use water tight submersible wiring methods, or hazardous methods and fittings rated for the environment;

(d) provide flood alarm

(e) electrical equipment shall be mounted as high as practicable;

(f) provide conduit back to a location such as a service room in a nearby building, to facilitate replacement or modification of wiring, label the conduit at each end to identify the location of the other end, and seal the conduit; and

(g) junction boxes shall be avoided in these areas, except for instrument terminations where the enclosure, methods, devices and fittings shall be rated for the environment.

C.12.23.6.2 Certain equipment is not to be installed below grade, per the *WWD Electrical Design Guide*.

C.12.23.7 Adequate Access Space

C.12.23.7.1 Design Builder shall install all electrical field equipment in a manner as not to obstruct plant staff access to other equipment as well as egress.

C.12.23.7.2 Install cable tray with minimum headroom of 3 metres above access ways, platforms or walkways and at a minimum vertical clearance of 600 millimetres in all other areas including cable tray installed above equipment. Install with greater headroom where tray would foreseeably interfere with the use of the space during normal operations or during maintenance, repair, replacement, or upgrading of equipment.

C.12.23.7.3 Where electrical equipment such as pushbutton-control stations and junction boxes are mounted along walkways that have handrails, mount the equipment above the handrails on separate supports.

C.12.23.7.4 Termination enclosures are to be placed such that plant staff can stand or kneel facing the enclosure to access them for modifying wiring connections. Leave room to open and close covers.

C.12.23.8 Seismic Requirements

C.12.23.8.1 Provide seismic design to dampen the effects of vibration, inertial process loads, or movement anticipated during electrical faults to lessen the damage and impact of temporary or constant forces.

C.12.23.8.2 Design Builder shall meet the following requirements at a minimum:

(a) provide equipment anchorage details for suspended equipment, coordinated with the equipment mounting provisions, prepared and stamped by the Professional of Record; and

(b) comply with the mounting recommendations provided by the manufacturer based upon the seismic design criteria.

C.12.24 Operations and Maintenance Requirements

C.12.24.1 Electrical equipment shall be designed and installed in such that it can be operated and maintained in compliance with Workplace Health and Safety regulations, by plant staff;

C.12.24.2 Operation and maintenance shall be achievable in a reasonably simple fashion and not hindered due to the design and constructing of the works;

(g) electrical hazards shall be minimized;

(h) electrical hazards shall be clearly identified in all cases;

(i) the system shall provide redundancy at all levels;

C.12.24.3 Design Builder shall:

(j) select equipment with due consideration for ease of maintenance;

(k) for equipment that if failed will have a significant impact on plant operation, provide such equipment in an n+1 redundancy configuration;

(l) Design and construct the Works such that electrical equipment operating strategies can be implemented to protect plant staff and the Infrastructure from damage due to an equipment failure while maintaining process viability;

(m) make all electrical equipment readily accessible, with sufficient clearances around equipment to facilitate all maintenance activities, including sufficient room and lay down area to remove the largest breaker or component. Provide lifting systems as required.

(n) design and construct the works such that all equipment can be safely isolated and padlocked to allow for maintenance work to proceed.

(i) Lock-out Tag-Out (LOTO) shall be provided for all forms of potential energy that could be hazardous to the maintenance worker. The first LOTO level shall be mechanical in nature, the second LOTO shall be the software monitoring and interlocks inhibiting normal operation except as manually performed by the maintenance worker as part of troubleshooting/testing.

C.12.24.4 Any E-stop, or initiation of LOTO shall require a manual reset of the control circuit, or control system in order to enable individual or system functionality. If the equipment under maintenance is part of a system, the software LOTO will monitor if the sensors and system is at a safe state to reset.

C.13 Automation

C.13.1 Codes and Standards

C.13.1.1 Design Builder shall adhere to the City Standards in Appendix 18D – City Standards

C.13.1.2 In addition, Design Builder shall conform with the following codes, standards and by-laws:

(a) Canadian Electrical Code;

(b) Winnipeg Electrical By-law; and

(c) NFPA 820.

C.13.2 Objective

C.13.2.1 Design Builder shall design, construct and support during testing and commissioning, a standalone headworks process control system (PCS) for the new Infrastructure. The system shall be designed, built, and programmed such that it will be capable of being fully integrated with the NEWPCC PCS.

C.13.2.2 Design Builder shall:

(a) adhere to the requirements stated in this document;

(b) adhere to the City Standards where it applies to the specific circumstances found at the NEWPCC;

(c) implement installation and migration phasing that minimizes downtime;

(d) provide a design where operator ease of use is a primary focus; and

(e) provide product support and warranty.

C.13.2.3 Full Integration of Facility Services

C.13.2.3.1 To meet the intent of this section, Design Builder shall review, and comply with the Technical Requirements of all other disciplines and sections as they relate to the PCS.

C.13.2.4 Standardized Equipment

C.13.2.4.1 The City has adopted an equipment standardization policy. Refer to Appendix 18E – Standardized Goods for the list of standardized equipment. Design Builder shall use the standardized equipment.

C.13.2.4.2 Design Builder shall be responsible for performing its own investigations and analyses to confirm that the equipment is appropriate for the application and duty. Design Builder shall notify the City if it has concerns that the use of particular standardized equipment may not meet the Technical Requirements.

C.13.2.5 Exceptions to the WWD Wastewater Treatment Facilities Automation Design Guide

C.13.2.5.1 Table 12 is a list of exceptions to the *WWD Wastewater Treatment Facilities Automation Design Guide* as it pertains to this project.

Table 12: Exceptions to WWD Wastewater Treatment Facilities Automation Design Guide

Section	Exception or Direction
3.10.1	New PLC installations that replace existing DCS PCUs shall use Schneider Electric Modicon M580 controllers in a hot-standby configuration with X80 series Remote I/O. Schneider Electric Modicon M580 controllers shall replace Schneider Electric Quantum controllers

C.13.3 Scope of Automation and Control

C.13.3.1 The scope of the headworks PCS encompasses the following components:

(a) process control and monitoring;

(b) building electrical system control and monitoring;

(c) building mechanical systems control and monitoring; and

(d) process sampling systems.

C.13.3.2 The headworks PCS shall include field instrumentation/devices, programmable logic controllers, wiring, communication fieldbus networks, supervisory control, human machine interfaces, data acquisition computers and any other required control devices to facilitate monitoring and control of the facility.

C.13.3.3 Design Builder shall provide Operations Manuals and Maintenance Manuals in accordance with Appendix 18F – O&M Information.

C.13.3.4 Design Builder shall provide training in accordance with Appendix 18G – Training Requirements.

C.13.4 Ancillary Systems

C.13.4.1 In addition to the headworks PCS, Design Builder shall integrate ancillary systems into the headworks PCS as per the WWD Automation Design Guide found in Appendix 18D – City Standards. Ancillary systems shall include:

(a) fire alarm system;

(b) security / access controls / video monitoring; and

(c) comply with the electrical power management control system load shedding requirements.

C.13.4.2 Design Builder shall provide, in spreadsheet format, a comprehensive itemized list of all monitoring and control data from the various ancillary systems available to be passed to the headworks PCS for operator monitoring or control. The City will review the available data for each system and provide the Design Builder

with a list of the selected data to be integrated into the headworks PCS for monitoring and control. Design Builder shall provide integration of all available data from these systems if so selected by the City.

C.13.5 Equipment Control

C.13.5.1 The required level of automation to be implemented at the facility is generally described as fully automated with the capability to manually override the automation locally and remotely through the PCS.

C.13.5.2 Design Builder shall submit, in spreadsheet format, a comprehensive itemized list of each piece of controlled equipment along with its proposed level of automation and modes of control.

C.13.5.3 The headworks facility electrical power shall be designed and built in such a way that it is able to meet the requirements of Appendix 18M – Classification of Loads.

C.13.5.4 Design Builder shall employ a distributed control philosophy. Local controls shall:

(a) be located within sight of the equipment to facilitate maintenance and manual operations;

(b) be located in a position that takes account of the physical constraints of the building layouts; and

(c) locate Field Operator Stations within 50 meters of controlled equipment; where the travel distance to an area or main control room exceeds 50 meters.

C.13.6 Instrumentation

C.13.6.1 Instrumentation and related components shall be furnished in accordance with Appendix 18B - Specifications, Appendix 18E – Standardized Goods, and the *WWD Wastewater Treatment Facilities Automation Design Guide*.

C.13.6.2 All instrumentation shall be appropriate for the application that it is installed in.

C.13.6.3 All instrumentation shall be rated for the area classification and category that it will be installed in. Intrinsically safe circuits shall be used where required to maintain the circuit safety in classified rated areas.

C.13.6.4 All instrumentation shall be rated for the service, range, and conditions that it will be measuring.

C.13.6.4.1 All instrumentation shall be installed according to the manufacturers' requirements.

C.13.6.4.2 All instrumentation shall have sufficient accuracy for the application and sufficient accuracy to produce a stable system. Instrumentation that the City identifies as being required for permitting may have required tolerances for accuracy error.

C.13.6.5 Discrete vs. Transmitter Selection

C.13.6.5.1 Design Builder shall provide analog transmitters for all process variable measurements and alarm detection to the extent possible for all critical systems and safety systems. Analog transmitters are also preferred for process variable measurements and alarm detection for non-critical systems.

C.13.6.6 Instrumentation Redundancy

C.13.6.6.1 Design Builder shall provide redundant instrumentation where the subject instrument(s) represent a single point failure node in a critical system and/or a safety system.

C.13.6.6.2 Design Builder shall provide redundant instrumentation in accordance with City Standards, Good Industry Practice and in accordance with the recommendations of Design Builder's HAZOP Study.

C.13.7 Fieldbus

C.13.7.1 Fieldbus networks, including PROFIBUS for smart field instruments and Ethernet for smart MCCs, shall be designed with sufficient number of network segments such that failure of any one segment does not compromise the firm treatment capacity of the associated process, electrical, or HVAC system.

C.13.7.2 Ethernet based fieldbus networks must be designed with a ring topology to the extent possible. Where Ethernet based field devices do not have ring topology capability, they may be connected to the nearest network switch.

C.13.7.3 Limit the maximum number of fieldbus devices connected to a network segment to 10 devices. Where a ring topology is used, the maximum number of connected devices can be raised to 15. Provide additional PLC network modules and/or network switches to achieve these requirements.

C.13.7.4 Design all networks to facilitate replacement of a field device without adversely affecting the network or controlled system function. Provide external end-of-line terminations as required to facilitate this requirement.

C.13.7.5 Design Builder shall review the impact of failure of each fieldbus segment and shall ensure that any failure does not impact the performance of the Infrastructure and is kept at a localized level.

C.13.7.6 Design Builder shall incorporate features to mitigate risk where single point failures of networked equipment may unduly compromise process integrity or control system reliability.

C.13.7.7 In the network design drawing, Design Builder shall clearly highlight the fieldbus network for critical processes and produce a report on failure modes of each identified segment.

C.13.8 Environmental Classification

C.13.8.1 Design Builder shall ensure that the equipment provided is suitable for the environmental conditions in which they are located. Further design requirements and standards addressing environmental conditions are found in the *WWD Wastewater Treatment Facilities Automation Design Guide*.

C.13.9 Automation Power Supply

C.13.9.1 Design Builder shall provide power supplies for all of the Headworks PCS and instrumentation in accordance with the *WWD Wastewater Treatment Facilities Automation Design Guide*.

C.13.9.2 Design Builder shall provide UPS power for all servers and network equipment and sufficient capacity for future server power requirements.

C.13.9.3 Design Builder shall prepare a schedule for each UPS showing connected loads, size, and anticipated battery run time.

C.13.10 Control System Architecture

C.13.10.1 Design Builder shall provide a pictorial representation of the proposed system network architecture for each process area as well as system failure analysis of each of the network devices and busses. In addition, an overall control system architecture drawing shall be provided.

C.13.11 HMI Client Configurations

[redacted]

[redacted]

C.13.12 Alarm Management

C.13.12.1 Design Builder shall provide an Alarm Management Plan in accordance with C.3.8.

C.13.12.2 All alarms shall be appropriate, relevant, and clear.

C.13.12.3 The alarm system shall have real time alarm management complete with:

(a) alarm shelving, which means the ability to temporarily suppress an alarm, with appropriate tracking and control;

(b) state-based alarming, which means the ability to have alarm set points set to a specific operation condition; and

(c) alarm flood suppression, which means the ability to use a single user input to manually shelf multiple related alarms that are consequential from a single alarm. The grouping of related consequential alarms shall be automatic.

C.13.12.4 There shall be a minimum of 3 levels of alarm priorities. Alarm priority shall consider personal safety, facility safety, and required response time of the City.

C.13.12.5 A list of alarms, complete with descriptions, priority, locations, tag numbers, associated PLC, associated area, and priority level shall be submitted in accordance with Appendix 18N – Design Submittal Requirements.

C.13.12.6 Alarm dead bands, thresholds, and timers shall be set to prevent repeated alarm chattering. Alarm threshold and timers shall be programmer tuneable and set such that nuisance alarms are eliminated.

C.13.13 Main Control Suite

[redacted]

C.13.14 Historical Data and Reporting

C.13.14.1 Design Builder shall provide a redundant historian server. The redundant historian server shall be located in the Main Control Suite. Refer to the *WWD Wastewater Treatment Facilities Automation Design Guide* for historical data and reporting.

C.13.15 Networking

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

C.13.16 Security

[redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]

C.12.23.2 Hazardous Location Classification

C.12.23.2.1 Design Builder shall meet the minimum electrical equipment requirements for the hazardous area classification as defined in CSA C22.1 and NFPA 820. Where NFPA 820 has more stringent requirements above those minimum requirements provided in CSA 22.1, or vice versa the more stringent shall apply.

C.12.23.3 Environmental Conditions

C.12.23.3.1 Electrical equipment shall be installed in a manner approved by the manufacturers and in accordance with environmental conditions.

C.12.23.3.2 Design Builder shall ensure the equipment is suited for the environmental conditions, and shall consider summer and winter conditions to ensure components/devices are used within their operating range and the following:

(a) in areas with sprinklers, provide equipment with suitable construction and CSA/NEMA rating;

(b) in outdoor locations, all works shall be suitable for climate extremes including extreme winds, direct sunlight, and shall be suitable for long term exposure to UV and atmospheric pollutants;

(c) with the exception of liquid filled transformers and associated NGRs, underground ductbanks and raceways, lighting and convenience receptacles, electrical equipment shall not be installed outdoors;

(d) consider environmental as well as hazardous location requirements. In process areas that are hazardous, there is generally also a wet and corrosive environment and the installation must be suitable for all of these conditions;

(e) specify and clarify the hazardous location wiring methods in alignment with relevant codes. Proper seals and barriers, and CSA approved wiring methods shall be employed; and

(f) be suitable for washdown in any process or shop areas subject to splashing or long term collection of dust or dirt due to exposure to a contaminant not generally present in other areas.

C.12.23.4 Corrosion Protection

C.12.23.4.1 Design Builder shall provide cathodic, impressed current, or other protection systems required based on the corrosion study and/or other process requirements. Coordinate with corrosion study in Appendix 18K – Special Studies and Models.

C.12.23.4.2 Electrical systems shall use materials that resist corrosion, that resist or

level monitoring applications where aggressive chemicals are used;

(l) provide line sized inline pressure sensors for all pressure monitoring applications for slurries and where coating or settling of the fluid may occur;

(m) monitor motor current and provide low current alarms for all submersible pumps and mixers;

(n) provide dew-point monitoring and alarms on all instrument air distribution systems;

(o) install flow measuring devices in accordance with manufacturer's recommendations for orientation, proximity to upstream/downstream disturbances, and for required upstream/downstream straight pipe length; and

(p) provide calibration ports/tees/tubing to allow calibration of instruments without removing the instrument.

C.13.18 Additional Design Requirements - HVAC

C.13.18.1 In addition to the requirements of Section C.11, Design Builder shall ensure that the headworks PCS design includes the following:

(a) the programmable logic controllers for HVAC purposes shall be separate from those used for process purposes;

(b) the ability to change setpoints and other parameters from headworks PCS;

(c) viewing trend log information for performance evaluation and troubleshooting assistance;

(d) operator user-initiated activity trail search capability;

(e) in process areas, control devices and instrumentation of industrial grade and suitable for the area classification and environmental conditions; and

(f) is capable of integrating multiple building functions, including equipment supervision and control, alarm management, energy management, and historical data collection and archiving.

C.13.19 Communications

C.13.19.1 All telephones provided in the upgraded Infrastructure shall be IP based.

C.13.19.2 Design Builder shall supply and install new racks, cabling, terminations and jacks for telephone handsets and switches.

C.13.19.3 The City will supply new phone handsets, and switches to be used for the telephone system. Design Builder shall install City supplied equipment.

C.13.19.4 Phones shall be provided in mechanical equipment rooms, electrical rooms, automation rooms, at each operator workstation, at each administrator workstation, and control rooms.

C.13.19.5 Each building shall have at least 1 phone.

C.13.19.6 Supply and install all required equipment and software to provide a public address system to cover all interior and exterior space.

C.13.19.7 The plant address system signals shall run between buildings by fibre and not electrically couple the buildings.

C.13.19.8 Design Builder shall provide interior speakers with ceiling mounted enclosures and multiple taps to adjust volume for interior speakers. Set speaker volume such that messages are broadcast at 5 dBA above ambient noise levels.

C.14 Operations and Maintenance

C.14.1 Criteria

C.14.1.1 Design Builder shall:

(a) consider safety in all areas of design and selection of equipment;

(b) provide equipment that is long lasting, low-maintenance, durable, serviceable and compatible with the environment and service in which the equipment items are to operate;

(c) provide for standardization of equipment e.g. all pumps of same type and similar duty shall be from one manufacturer;

(d) provide the Infrastructure with all necessary systems, including controls and automation, to facilitate regular scheduled operator and maintenance intervention on the basis of Standard Staffing Levels;

(e) consider during selection, the complexity of equipment maintenance, both routine and corrective, and the level of competence required from plant staff;

(f) ensure that all parts, equipment, systems and components will be of new supply solely and used solely for service at the Infrastructure;

(g) provide portable guardrail sections and storage racks in accordance with Section C.5.6.7 and as follows:

(i) sufficient length of portable guardrails to go around the largest floor opening in the room for one process train (tank and channels); and

(ii) designed for use as a protective barrier during maintenance, when covers or grating are removed;

(h) provide removable bollards around equipment and doorways near indoor and outdoor traffic areas;

(i) provide removable barriers, to protect floors and grated areas not designed for traffic loads, and to prevent vehicle or forklift traffic in these areas;

(j) provide the capability to safely manage all on-site refuse and residuals generated at the Infrastructure;

(k) prevent electrolytic action between dissimilar metals and materials. Insulate all mating surfaces from each other to provide protection against corrosion, including all hardware; and

(l) consider future requirements, including making reasonable allowances in accordance with Good Industry Practice for the installation and tie-in of future pipes, conduits, access ways, tanks, treatment processes, buildings and other infrastructure.

C.14.2 Redundancy

C.14.2.1 Design Builder shall:

(a) ensure no single point of failure will result in a critical aspect or process at the Infrastructure that would risk an excursion from or non-compliance with any Applicable Law or requirement of a Governmental Authority. If equipment failure will have a significant impact on the operation of the Infrastructure, Design Builder shall provide such equipment in duplicate, as a minimum, under governing design conditions with one unit out of service; and

(b) provide reasonable alternative method by which fluids may be routed around specific treatment units for the purpose of maintenance, repair or future upgrade; as long as redundant units provide sufficient capacity to maintain operational performance.

C.14.3 Operability

C.14.3.1 Design Builder shall:

(a) ensure that operating strategies can be implemented to protect plant staff and the Infrastructure from damage due to equipment failure without interrupting the treatment process;

(b) ensure valves and gates can be operated from above tank and channel covers and normal floor level;

(c) provide provisions for manual operation of all actuated gates and valves;

(d) provide all necessary systems to allow for automatic and PCS controlled switching between duty and standby equipment;

(e) include for pedestrian traffic with respect to an operator's normal rounds and traffic between buildings;

(f) ensure check valve swing arms are positioned, or protection is provided, to avoid persons being struck;

(g) ensure chain operators for valves can be secured out of the way of persons and all means of egress; and

(h) provide a potable water source back-up for equipment that normally uses flushing water including screens, screenings washer/compactor, and grit fluidization.

C.14.4 Maintainability

C.14.4.1 Design Builder shall:

(a) demonstrate in its Design Submittals the provision of space and systems provided for equipment maintenance, laydown, removal and replacement, including:

(i) space for laydown of components, assemblies, internal components, and temporary works necessary to undertake maintenance or replacement;

(ii) a list of materials, supplies and equipment lifting tasks identifying the safety requirements for each task;

(iii) a description of the equipment or supplies requiring a lift, that at a minimum shall include all items heavier than 25 kg;

(iv) a description of the means to replace equipment, that at a minimum shall include all items heavier than 25 kg;

(v) dimensions and weight of equipment or supplies being lifted;

(vi) the start, transfer and finish location for each lifting task;

(vii) the proposed lifting equipment for each task;

(viii) the routes and provisions to transport the equipment to and from the vehicle that hauls the equipment to and from the Maintenance Building or off-site locations; and

(ix) where a lift will require significant lifting capacity provided by a mobile crane, e.g. greater than 5 tonnes, provide an engineered lift plan for each proposed heavy lift.

(b) make all equipment accessible and at functional working height where possible, with sufficient clearances around equipment to facilitate all maintenance activities, including sufficient room and lay down area to remove the largest component. The laydown area must be reachable by the lifting device;

(c) locate maintainable equipment in accessible locations; maintainable equipment must not be installed in a false ceiling or underfloor grating;

(d) locate pipelines requiring frequent maintenance in accessible locations;

(e) minimize the need to disconnect pipe and conduit for maintenance;

(f) not include the use of ladders or scaffolds for equipment requiring routine maintenance and lubrication of equipment more than once per year according to manufacturers recommended maintenance schedule. If more frequent access is required, then stairs, platforms, guard rails and/or anchor points must be provided;

(g) locate equipment with ample space and lighting for inspection and maintenance and adequate provision for removal for maintenance or replacement without interrupting treatment plant operations;

(h) for equipment requiring greasing, extend grease nipples such that they are easily accessible and provide grease pressure relief to prevent over-greasing;

(i) ensure equipment maintenance, overhaul or removal will not require the dismantling of permanent infrastructure or the relocation of other fixed equipment;

(j) provide operator walkways with clear direct paths to all equipment;

(k) provide equipment removal (including installation of future replacement equipment) corridors to enable access for removing all equipment in the Infrastructure with a minimum of 600 millimetres on all sides, or a minimum of 2.0 metres clear width and 2.5 metres clear height, whichever is greater. Such removal corridors shall have sufficient turning radii to allow the equipment to be maneuvered through the Infrastructure and removed through doors or other means permitted by the Technical Requirements;

(l) provide access paths or walkways at least 1.0 metre wide clearance where only person access is required;

(m) provide manufacturer recommended clearances or a minimum clearance of 1.0 metre, whichever is greater, for access between all equipment and valves, pipework and structures to facilitate operation and maintenance activities;

(n) ensure all equipment can be safely isolated to allow for maintenance work to proceed;

(o) include adequate and appropriately located flushing connections and drain points to relieve pressure and/or drain fluid/gasses at point of disassembly;

(p) provide power outlets throughout the Infrastructure readily accessible to all equipment, hatches, manways and tank openings to facilitate portable lighting systems, ventilation systems, and maintenance equipment;

(q) provide non-obstructive access to adjustment points, test points, oil and greasing points, and filling and draining points on all equipment;

(r) provide simple and safe means to access, isolate, purge and remove all installed instrumentation components without disrupting the treatment process;

(s) ensure that any equipment that is to be removed (including installation of future replacement equipment) from the Infrastructure through an exterior opening in a wall or roof of a building uses a removable louvre or removable panel that meets the following requirements at a minimum:

(i) shall be integrated with the architectural design of the Infrastructure;

(ii) shall be weatherproof and integrated within the building envelope;

(iii) shall include lifting lugs or equivalent means to allow removal using a mobile crane located on a roadway of the Infrastructure immediately adjacent to the opening;

(iv) fasteners holding the removable louvre and panel in place shall be readily accessible and remove from the inside of the exterior wall without use of special equipment and by one person, while the crane is lifting the louvre or panel on the outside of the building; and

(v) fall protection shall be provided for each opening;

(t) provide foundations (including concrete pads) for equipment removal and replacement that requires the use of tower and jib cranes to be erected. The tower/jib crane foundations shall be located so that they are easily accessible and to ensure that equipment on the roof of the Infrastructure and/or lifted from inside the Infrastructure can be landed directly on a truck at ground level.

C.14.5 Access Hatches

C.14.5.1 Design Builder shall provide hatches that meet the following requirements for inspection/sampling hatches:

(a) opening size shall be 400 millimetres by 400 millimetres;

C.14.5.2 Sampling hatches shall be provided to facilitate easy access for sampling with extendable pole and basic inspections without the need for fall arrest systems and at locations in accordance with Appendix 18L – Sampling and Analytical Plan

C.14.5.3 Design Builder shall provide hinged hatches in the following locations:

(a) above all non-pressurized tanks, channels and spaces that are representative of its contents;

(b) in covered tank systems at a location above each effluent launder;

(c) at all inlet and outlet locations of individual tanks and common channels that provide a representative sample; and

(d) above each individual cell/zone within any process tank.

C.14.5.4 All hatches shall include:

(a) a painted yellow border around the opening; and

(b) a gravity closing centre bar.

C.14.5.5 Maintenance Hatch

C.14.5.5.1 Maintenance hatches shall have a minimum opening size of 1,200 millimetres by 1,200 millimetres to facility person entry, tank wash downs, vacuum truck hose access, temporary lighting, ventilation, and equipment inspections;

C.14.5.5.2 Design Builder shall provide this hatch type in the following locations:

(a) at an interval of every 6.0 metres, at a minimum, along all covered channels and process tankage locations;

(b) adjacent to any major mechanical equipment inside a process tank that can be inspected for operation and maintenance from the deck level, including tank mixers, scum troughs, and effluent launders;

(c) at logical locations above all process tanks that will provide access to equipment below;

(d) locate hatches adjacent to major equipment;

(e) space hatches along center line of covered channels and process tankage;

(f) one hatch directly above the lowest point inside any covered process tank to facilitate tank draining;

(g) one hatch directly above the influent and effluent ends of any covered channel; and

(h) above each individual cell/zone within any covered process tank.

C.14.5.5.3 All hatches shall include:

(a) a painted yellow border around the opening;

(b) temporary guardrails;

(c) self-closing mechanism, either by gravity or by spring;

(d) rated and labelled tie off point for personnel; and

(e) a clear distance of 2.0 m to the opening for unrestrained personnel.

C.14.5.5.4 Hatches shall be designed to support temporary ventilation piping. Ventilation piping shall be designed for the needed air flow rates to ensure purging of the space. Temporary pipe supports shall be provided as necessary.

C.14.5.6 Equipment Removal Hatch

C.14.5.6.1 Design Builder shall provide equipment removal hatches that:

(a) facilitate extraction and replacement of the largest piece of equipment;

(b) are sized for the largest piece of equipment to be removed through the hatch plus a minimum of 400 millimetres clearance on all sides;

(c) are located where a hatch opening is required to facilitate removal and replacement of equipment in the Infrastructure;

(d) are load-rated when in the travel path of forklifts and pallet jacks at their maximum loaded capacity;

(e) include:

(i) a painted yellow border around the opening;

(ii) self-closing mechanism, either by gravity or by spring; and

(iii) temporary guardrails;

C.14.5.7 Ventilation Hatch

C.14.5.7.1 Design Builder shall provide ventilation hatches that:

(f) have a minimum opening size of 400 millimetres by 400 millimetres;

(a) allow adequate air flow during inspection or maintenance; and

(b) are located where temporary ventilation is required to allow access.

C.14.5.8 Housekeeping

C.14.5.8.1 Design Builder shall:

(a) design to permit removal of waste solids, domestic trash and recycling materials from the Infrastructure without excessive costs and labour;

(b) provide colour coded trash, waste, and recycling collection equipment and pails that are easily accessible along corridors;

(c) provide an adequate drain and sump system to handle dirty water from all housekeeping and equipment cleaning operations, and minor flooding;

(d) provide adequate sources of flushing water for building and equipment cleaning; and

(e) ensure that windows, air intakes, louvres, etc. are accessible for cleaning.

C.14.5.9 Floor Drainage

C.14.5.9.1 Design Builder shall:

(a) ensure all tunnels, passageways, galleries and basement slabs are crowned in the middle and sloped at a minimum 2 percent to the internal bottom of wall drains and/or trenches/sump pits to provide a standby system for collection of unplanned leakage into these areas;

(b) provide trench style gutter drains on both sides of tunnels, passageways and galleries;

(c) provide gutter drain covers at locations where plant staff will be crossing over the gutter drain;

(d) slope process floor areas a minimum of 2 percent to gutter drains or floor drains;

(e) provide drains and sump system to remove dirty water from washdown areas to facilitate housekeeping and equipment cleaning operations, and to manage minor flooding;

(f) provide drains at all eye wash and shower stations;

(g) slope all floors to drain to a gutter located at the interface of adjoining walls;

(h) slope walkway and traveled areas with a crown draining to gutter drains on either side located at the adjoining wall interfaces;

(i) provide a minimum 200 millimetres diameter or larger drains, as required, to suit area and facilitate equipment washdown; and

(j) identify drain locations with symbols painted on the floor and adjacent wall.

C.14.5.10 Utility Stations and Hot Water Systems

C.14.5.10.1 Design Builder shall:

(a) include utility stations in all process areas, including the deck and floor level of all process tankage, process equipment areas, galleries and loading areas;

(b) provide sufficient number of utility stations to cover the entire floor area so that the maximum connected length of hose is 15.0 m;

(c) provide utility stations at locations to facilitate room, equipment and tank washdowns, pipe flushing, pneumatic tool operations, and any other service requirements specific to the area being serviced;

(d) provide utility stations adjacent to all process area exterior building exit doors and all truck bay exits. Utility station to be located on the inside of the building;

provide utility stations adjacent to all manway access to inside a tank at the tank floor level;

(e) provide utility stations in an indoor location or ensure no freezing if tank is located outside;

(f) provide two standard service connection and hose sizes at each utility station: 40 millimetres pipe thread hoses and 20 millimetres pipe thread hoses;

(g) service all utility stations with flushing water and instrument air, as follows:

(i) flushing water cold: minimum flow of 5 L/s at a minimum residual pressure of 550 kPa at the hose station and serviced by a minimum 40 millimetres diameter flushing water line; and

(ii) instrument air: dried and compressed from atmospheric pressure to 690 kPa and serviced by a 20 millimetres diameter instrument air line.

(h) provide hot potable water pressure washer system(s) with available operating pressure up to 206 bar, a minimum heating capacity of 175 kWh, and a minimum flow rate of 0.38 L/s;

(i) acceptable products:

(i) Hotsy hot water pressure washer with multiple-gun option (Model: 1800 Series)

(ii) Magikist hot water pressure washer with multiple-gun option (Model: HW Series)

(iii) Washex hot water pressure washer with multiple-gun option (Model: HSE Series)

(j) include remote hot water washing stations, including hose reel and trigger gun, to service the following areas:

(i) raw sewage pumping station wet well area at platform level in the wet wells;

(ii) influent screens and screenings handling areas to facilitate room and equipment washdown of influent screens, compactors and screenings bin areas;

(iii) grit removal and grit management areas to facilitate room and equipment washdown of grit tanks, grit dewatering and dewatered grit bin areas;

(iv) any other area that requires hot-water cleanup.

C.14.5.11 Sampling Provisions

C.14.5.11.1 Design Builder shall:

(a) demonstrate in its Design Submittals all sampling provisions at the Infrastructure;

(b) include provisions to collect samples in accordance with the locations set out Appendix 18L – Sampling and Analytical Plan;

(c) include additional sampling locations to allow for process

monitoring and troubleshooting as required to suit Design Builder's Design and as recommended by equipment manufacturers;

(d) ensure all sampling locations are representative of actual process stream conditions;

(e) include all proposed sampling locations in its Design Submittal;

(f) provide all composite samplers and permanently install in place in accordance with the Appendix 18L – Sampling and Analytical Plan;

(g) locate all composite samplers in unclassified areas;

(h) provide and install all sampling points, and sample equipment in accordance with Appendix 18L – Sampling and Analytical Plan;

(i) include sampling stations to accommodate the sampling requirements outlined in Appendix 18L – Sampling and Analytical Plan;

(j) provide sampling points located at the inlet and outlet of all process tankage where a sample can be obtained that is representative to carry-out a mass balance around each individual unit;

(k) provide sampling points on the discharge of all pumps;

(l) provide a means for easy access to sample all applicable commodities at the inlet and outlet of all process handling equipment;

(m) provide the ability to install a portable composite sampler on any sampling port; and

(n) provide a chemical sampling line at each chemical offloading fill station.

C.14.5.12 Hoists, Cranes, Lifting Devices

C.14.5.12.1 Design Builder shall:

(a) ensure all permanent and temporary lifting devices are integrated into the design of the Infrastructure superstructure;

(b) provide a means to access, remove and replace all equipment at the Infrastructure with the fewest lifts practical, and with no more than 3 lifts;

(c) ensure lifting equipment is provided for all equipment, covers and

hatches heavier than 25 kg and for items less than 25 kg where location constraints or nature of the equipment could result in manual lifting being deemed unsafe;

(d) ensure that the types of lifting equipment are either bridge cranes, gantry cranes, monorails, davit or jib cranes;

(e) provide lifting devices that are sized for the greater of 2 tonnes or to accommodate lifting the heaviest equipment component, without disassembly, in accordance with Good Industry Practice;

(f) provide a common bridge crane, in areas where there are multiple pieces of equipment or in areas where removable tank covers are installed;

(g) ensure that where common lifting systems are installed over expansion joints, provide spliced joints to crane rails and runway beams to allow up to 15 millimetres of movement without affecting the operation of the lifting unit or its ability to travel the full length of the rails or beams without jamming;

(h) capable of removing all equipment inside tanks and landing such equipment at the deck level; and

(i) complete with dedicated landing and laydown areas, that is accessible by the bridge crane with sufficient space to accommodate the largest equipment component plus space for access by forklift. Such landing and laydown areas shall be located to ensure they do not impact operations and/or maintenance of any other equipment, normal treatment operations and activities, safety, or regular accessibility and circulation paths in the room space.

(j) ensure all engineered lifting devices and apparatuses such as crane, hoist, access hatches and anchor points are provided for equipment removal and replacement. If these devices are to be removed following the final installation then there shall be an area to store the equipment;

(k) ensure hoist and trolley capacities for cranes and monorails installed in classified areas are rated accordingly;

(l) ensure hook travel limits are shown on process and structural drawings;

(m) ensure that bridge cranes have a separate drive on the housing for “inching” or “stopping” equipment;

(n) ensure bridge cranes have wireless controls, not pendants;

(o) ensure all lifting devices contain capacity labels;

(p) provide clear markings of the load capacity of each area including hatches, pedestrian access ways with covers, and areas that may temporarily support heavy equipment; and

(q) ensure equipment that require hoisting with slings are designed to deviate 30 degrees from equilibrium without suffering damage.

C.14.6 Spare Parts and Maintenance Materials

C.14.6.1 Design Builder shall be responsible for the supply of all required spare parts, tools, supplies, and consumables as outlined within this section and throughout the Technical Requirements.

C.14.6.2 Design Builder shall maintain a complete list of spare parts, tools, supplies and consumables that are supplied with the Works.

C.14.6.3 Any supplies, spare parts or consumables used incidentally in the operation and maintenance of the works by Design Builder shall be replaced before Substantial Completion.

C.14.6.4 Design Builder shall provide all spare parts information in accordance with Appendix 18F – O&M Information.

C.14.6.5 Design Builder shall be permitted to use any supplied specialty tools in the construction and commissioning of the Works, however, if tools are no longer in a condition similar to new (corrosion, damage, missing parts, etc.), as determined by the City, they shall be replaced before Substantial Completion, at Design Builder's cost.

C.14.6.6 Design Builder shall be responsible for supplying both space within buildings and appropriate metal storage within that space for all tools, spare parts, supplies and consumable required for the Works. Storage areas shall be dry, environmentally controlled and secure. Consumables shall be stored in the same building as the equipment that requires them is located.

C.14.6.7 Design Builder shall provide sufficient consumables such as filters, lubricants and cleaning products to operate and maintain the Infrastructure for two years of normal operation after Final Completion.

C.14.6.8 Design Builder shall provide sufficient spare parts to operate and maintain the Infrastructure for two years of normal operation after Final Completion.

C.14.6.9 Design Builder shall replace all air filters after all painting and finishing work is completed before Final Completion.

C.14.6.10 Design Builder shall protect all biological odour control systems from damage resulting from painting or finishing work, as required. Design Builder shall repair, replace, or reseed biological systems that have been damaged.

C.14.6.11 Design Builder shall replace activated carbon media prior to Final Completion.

C.14.6.12 Design Builder shall provide all special tools and software recommended by the manufacturer and required to operate and maintain all Infrastructure.

C.14.6.13 Design Builder shall provide all spare parts specified in Appendix 18B – Specifications.

C.14.6.14 Before Substantial Completion, Design Builder shall:

(a) prepare and submit a consolidated list identifying all required spare parts, special tools, consumables, expendables, and other wear components to be provided as required in the Technical Requirements and in accordance with Appendix 18F – O&M Information;

(b) identify if there is any equipment at the Infrastructure for which the manufacturer recommends additional spare parts, consumables, expendables or other wear components not included in Schedule 18 or Appendix 18F – O&M Information, and provide all such equipment;

(c) catalogue, place, store, and protect spare parts and maintenance materials at the Infrastructure in accordance with manufacturer's recommendations and protect spare parts subject to deterioration, such as ferrous metal items or electrical components, with lubricants and desiccants, hermetically sealed in plastic wrap. Spare parts or maintenance materials heavier than 25 kg must be accessible in accordance with the Equipment Lifting and Replacement Plan. Spare parts or maintenance materials heavier than 10 kg must be accessible and stored at a height not greater than 1.5 metres; and

(d) store smaller spare parts in hinged wooden boxes that:

(i) are painted with stenciled lettering indicating "Spare Parts for Tag x-xxx"; and

(ii) contain an inventory sheet in a heavy-duty plastic protective sleeve that is affixed to the underside of the cover.

C.15 Reuse of Existing Infrastructure

C.15.1 General

C.15.1.1 Reused facilities shall meet applicable local and national building codes and follow City Standards while maintaining existing functional services.

C.15.2 Existing Infrastructure Not to Be Reused

C.15.2.1 The following structures shall not be reused in the upgraded sewage treatment plant:

(a) raw sewage surge well;

(b) raw sewage pump wells;

(c) raw sewage pumping station discharge chamber; and

(d) screening and grit removal facility, except the flushing water pumping station and grit effluent channel.

C.15.2.2 Design Builder shall decommission the buildings listed above per the requirements specified in Section C.16.

C.15.3 Existing Infrastructure for Reuse

C.15.3.1 Design Builder, at its sole discretion, may reuse the Existing Infrastructure, unless explicitly stated in the Technical Requirements. The City makes no representations and warranties as to the condition, performance, or service life of the Existing Infrastructure. Design Builder shall perform all necessary due diligence and investigations to satisfy itself that such Existing Infrastructure can be reused as part of Infrastructure. Design Builder shall be solely responsible for upgrading Existing Infrastructure to meet applicable codes, standards, and City Standards and these Technical Requirements.

C.15.3.2 Interceptors

C.15.3.2.1 Three interceptors convey raw sewage from the NEWPCC catchment area to the NEWPCC and may be reused. Upgrade or rehabilitation of the interceptors is not within the scope of this Project; however, Design Builder shall be responsible for connecting the interceptors to the new interceptor junction chamber in accordance with Appendix 18A – Process Functional Requirements. For clarity, Design Builder shall repair any damage caused to the interceptors while performing the interconnections at no extra cost to the City.

C.15.3.3 Outfall

C.15.3.3.1 The outfall from the downstream edge of the UV disinfection building to the Red River may be reused. Upgrade or rehabilitation of the outfall is not within the scope of this Project; however, Design Builder shall be responsible for providing interconnections to the outfall in accordance with Appendix 18A – Process Functional Requirements. For clarity, Design Builder shall repair any damage caused to the interceptors while performing the interconnections at no extra cost to the City.

C.15.3.4 Grit Tanks Effluent Conduit

C.15.3.4.1 The existing effluent conduit for the de-gritted wastewater may be reused to connect the new headworks effluent conduit to the existing primary influent conduit.

C.15.3.5 Primary Influent Conduit

C.15.3.5.1 Design Builder shall reuse the existing primary influent conduit to convey grit effluent to the primary influent distribution chamber.

C.15.3.6 Tunnels and Galleries

C.15.3.6.1 There are 8 existing tunnels and galleries located within the Existing Infrastructure. Design Builder may reuse or repurpose these tunnels and galleries. If Design Builder elects to reuse or repurpose the existing tunnels and galleries, Design Builder shall be solely responsible for determining the structural integrity of the of tunnels and galleries and shall design and construct all necessary modifications, including structural, HVAC and electrical, to meet applicable codes and standards.

C.16 Decommissioning

C.16.1 General

C.16.1.1 Design Builder shall be responsible for decommissioning all components of the existing facilities that do not form part of the Infrastructure in accordance with the Final Design unless otherwise directed by the City.

C.16.1.2 Design Builder shall develop its own inventory of infrastructure for decommissioning. Design Builder shall not rely on the existing as-built or record drawings in developing its inventory.

C.16.1.3 Design Builder shall be responsible for removal and disposal of the waste material created by decommissioning activities.

C.16.1.4 Before major components of the existing facilities ceasing operation, Design Builder shall comply with the terms and conditions of any Governmental Authority having jurisdiction for reclamation and decommissioning, Applicable Law, standards, codes, and guidelines and Permits, Licences and Approvals.

C.16.1.5 Decommissioning activities shall not begin until the Certificate of Performance Testing Completion has been issued to Design Builder by the City Representative.

C.16.2 Criteria

C.16.2.1 Design Builder shall:

(a) ensure that all open excavations are protected before backfilling to ensure safety of the public and plant staff;

(b) ensure that abandoned underground lines, pipes, conduits and channels are capped, plugged or sealed in accordance with Good Industry Practice to prevent ingress of liquid;

(c) make arrangements with the utilities to disconnect service lines entering areas to be demolished in accordance with the requirements of any Government Authority;

(d) purge all underground gas piping;

(e) remove all unused piping, pipe supports, pipe hangers and pipe racks in buildings, structures, tunnels and galleries;

(f) remove all unused wiring, cables and cable trays, in buildings, structures, tunnels and galleries;

(g) remove hazardous materials in such a manner to prevent distribution of hazardous material around the site;

(h) at end of each work day, leave work in a safe condition such that no parts are in danger of toppling or falling; and

(i) be responsible for the removal of all unused equipment with co-ordination through the City Representative. The City has the right of first refusal and may choose to salvage any of the equipment removed by Design Builder.

C.16.3 Existing Infrastructure to be Decommissioned

C.16.3.1 Process Equipment and Piping

C.16.3.1.1 Design Builder shall remove all process equipment and piping in facilities to be decommissioned including:

(a) pumps;

(b) valves;

(c) gates;

(d) motors;

(e) mixers;

(f) actuators;

(g) tanks;

(h) blowers;

(i) process piping within buildings or tunnels including flushing water; and

(j) pipe racks within buildings or tunnels.

C.16.3.1.2 Buried piping entering or exiting the facility shall be decommissioned.

C.16.3.1.3 For facilities that will be repurposed or retained for future use, all penetrations shall be plugged with concrete and finished to match the surrounding wall.

C.16.3.1.4 Ensure uplift will not occur in decommissioned tankage.

C.16.3.2 Mechanical Equipment

C.16.3.2.1 For facilities being decommissioned, Design Builder may keep all heating and ventilation units.

C.16.3.2.2 Mechanical equipment shall also include:

(a) hot water and return water pipes within buildings and tunnels including insulation; and

(b) pipe racks within buildings and tunnels.

C.16.3.3 Electrical Equipment

C.16.3.3.1 Design Builder shall remove all electrical equipment required for process operation under the existing process operation regime.

C.16.3.3.2 Electrical equipment shall also include:

(a) junction boxes;

(b) mounting equipment;

(c) power monitoring equipment;

(d) electrical cable within buildings and tunnels;

(e) electrical cable within underground conduits; and

(f) cable trays within buildings and tunnels.

C.16.3.3.3 Design Builder will be permitted to leave lighting and 110/120 V and 220/240 V receptacles, provided these items are operational. If these items are damaged during decommissioning activities, Design Builder shall replace these items with a similar operational item.

C.16.3.3.4 All switching to de-energize existing cables and equipment will be performed by plant staff, as applicable.

C.16.3.3.5 Electrical and control service to equipment that is to remain in service shall be relocated and fed by new power sources and new or existing control interfaces and the equipment energized and demonstrated before decommissioning of the original electric and control service connections and feeders.

C.16.3.4 Instrumentation and Control Equipment

C.16.3.4.1 Design Builder shall remove all instrumentation and control equipment.

C.16.3.4.2 Instrumentation and control equipment shall also include:

(a) primary elements;

(b) transmitters;

(c) junction boxes;

(d) DCS equipment;

(e) operator workstations;

(f) field devices;

(g) process networking equipment;

(h) instrumentation cable within buildings and tunnels;

(i) instrumentation cable within underground conduits; and

(j) cable trays within buildings and tunnels.

C.16.3.4.3 Where Design Builder elects to reuse existing building mechanical and electrical systems to maintain existing structures, the building mechanical and electrical must be connected to the new PCS.

C.16.3.5 Surge Well

C.16.3.5.1 Design Builder shall decommission the surge well, plug all incoming and outgoing conduits and perform any additional work required to ensure the surge well can be periodically maintained while ensuring the surge well does not shift, settle, or lift excessively, causing damage to the Main Building, once the surge well is no longer in use. Design Builder shall also evaluate the structural integrity of the surge well and shall consider ground frost effects, groundwater penetration and the need for heating, dewatering and backfilling.

C.16.3.5.2 In addition to raw sewage, the surge well receives flow from several other sources including the Main Building drains, digester drain and primary clarifier 1, 2 and 3 drain. Design Builder shall redirect these flows away from the surge well. Redirecting these flows to the interceptor sewer system will be acceptable.

C.16.3.5.3 Damage and disruption to the surrounding infrastructure shall be minimized as the Main Building will be reused.

C.16.3.6 Raw Sewage Pump Wells

C.16.3.6.1 Design Builder shall decommission the existing raw sewage pump wells and plug all incoming and outgoing conduits.

C.16.3.6.2 Damage and disruption to the surrounding infrastructure shall be minimized as the Main Building will be kept in service.

C.16.3.6.3 Design Builder shall assess structures and provide a maintenance manual to minimize damage to the raw sewage pump wells and surrounding infrastructure. Such maintenance manual will be used by the City for maintenance in the long-term.

C.16.3.6.4 Design Builder shall cover two pump wells with structural floors such that the floor space currently occupied by the pump wells can be repurposed. The third pump well shall remain uncovered, with hand railings, and maintained as a historical monument. Architectural finishes shall match existing finishes. Design Builder shall select which pump well will remain as a historical monument and shall demonstrate how covering of the other 2 pump wells will provide flexibility and efficiency in repurposing the space.

C.16.3.6.5 Design Builder shall install any equipment, including sump pumps, required for maintaining the pump wells to prevent the space from becoming a hazardous space and premature degradation. Sump pumps shall be fully integrated with the PCS, including all alarming, and may discharge to an interceptor upstream of the raw sewage pump station.

C.16.3.7 Discharge Chamber

C.16.3.7.1 Design Builder shall decommission the discharge chamber and plug all incoming and outgoing conduits.

C.16.3.7.2 In addition to pumped raw sewage, the discharge chamber receives flow from other sources including the flow from the sump pumps in the existing raw sewage pumping station dry wells. Design Builder shall redirect these flows away from the discharge chamber. Redirecting these flows to the interceptor sewer system will be acceptable.

C.16.3.7.3 Damage and disruption to the surrounding infrastructure shall be minimized as the Main Building will be reused.

C.16.3.7.4 Design Builder shall assess structures and provide a maintenance manual to minimize damage to the discharge chamber and surrounding infrastructure. Such maintenance manual will be used by the City for maintenance in the long-term.

C.16.3.8 Screenings and Grit Removal Facility

C.16.3.8.1 Design Builder shall decommission all process equipment in the screenings and grit removal facility in accordance with this Section C.16.3.8 except;

(a) flushing water pumping system;

(b) 150 mm process air header to primary clarifiers 4 and 5;

(c) all electrical equipment required to service flushing water pumping system, building mechanical equipment, and any electrical

receptacles and lighting; and

(d) all heating, ventilation, and other building mechanical equipment required to preserve the life of the structure.

C.16.3.8.2 The backwash from the flushing water strainer is currently directed into the existing screen channel. Since this channel will not be reused as part of the Infrastructure, Design Builder shall redirect the backwash, such that the backwashing system is not compromised.

C.16.3.8.3 Damage and disruption to the surrounding infrastructures shall be minimized as the flushing water pumping system will be reused.

C.16.3.8.4 Electrical and building mechanical equipment may be reused.

C.16.3.8.5 Design Builder shall assess structures and provide a maintenance manual to minimize damage to the discharge chamber and surrounding infrastructure. Such maintenance manual will be used by the City for maintenance in the long-term.

C.16.3.9 Tunnels and Galleries

C.16.3.9.1 Design Builder shall remove all process piping, electrical and instrumentation cabling, cable trays, flushing water piping, HVAC piping, and pipe racks in tunnels and galleries that will not be reused or repurposed in the upgraded plant.

SECTION D. CONSTRUCTION

D.1 General

D.1.1 Responsibilities

D.1.1.1 Design Builder shall have control of the construction and shall effectively direct and supervise the construction so that it is undertaken in compliance with the terms of this DBA. Design Builder shall be responsible for all construction means, methods, techniques, sequences and procedures with respect to the construction and for coordinating the various elements of the construction, and nothing in this DBA shall be interpreted as giving any responsibility for the construction to the City, the City Representative, or any City Person.

D.1.1.2 Design Builder shall not commence construction until the Construction Commencement Conditions as set out in Section D.1.7.1 have been satisfied.

D.1.1.3 Without limiting any other obligation of Design Builder under this DBA, Design Builder shall perform all construction in strict conformity with the latest Submittals for which Design Builder has obtained a “Received” or “Observations” endorsement in accordance with Schedule 5 - Review Procedure.

D.1.1.4 Construction includes decommissioning, and further to this Section D.1.1 shall apply to decommissioning works.

D.1.1.5 Design Builder shall ensure that construction conforms to the Technical Requirements and the Final Design. Any changes to the Final Design during construction shall be addressed in accordance with Section C.1.3.22 of this Schedule 18.

D.1.1.6 Further to Section D.1.1.5 of this Schedule 18, Design Builder is responsible to compile and record information on the dimensions and physical characteristics of the Infrastructure based on the actual construction activities.

D.1.1.7 Design Builder shall ensure all construction is of a high quality workmanship and all materials incorporated into the Work shall meet long-term safety, functionality/serviceability, durability/maintainability, accessibility design, crime prevention through environmental design and aesthetics and any other City requirements as reasonably requested.

D.1.1.8 Design Builder shall ensure that only new materials are incorporated into the Work. For clarity, this is not applicable for Design Builder's temporary construction materials (e.g. scaffolding, concrete formwork, storage tents, etc.).

D.1.1.9 Design Builder shall ensure that all personnel in an area that may contain Hazardous Substances shall be trained to recognize Hazardous Substances and make appropriate arrangements to have the substance removed as part of the Works.

D.1.1.10 Except for Environmental Damage or Degradation as indicated in Section D4 of the DBA, Design Builder shall be responsible for all testing and remediation, in accordance with Section D.4.8, of all Hazardous Substances that may be disturbed as part of the Works.

D.1.2 Equipment Supply and Installation

D.1.2.1 Without limiting anything in the Technical Requirements, Design Builder shall complete the Works to accommodate the installation, operation, repair and maintenance of all the plant equipment, including as required all electrical, data and plumbing connections, structural support and space for efficient access, replacement and maintenance, all to the tolerances and specifications as may be specified and required by the manufacturers or suppliers of such equipment or in the Technical Requirements.

D.1.2.2 Design Builder shall only select equipment, manufacturers, or vendors that will have or provide spare parts for the design life of the equipment.

D.1.3 Protection of Materials and Equipment

D.1.3.1 Design Builder shall be responsible for the secure storage of materials and equipment at the laydown and staging areas and the protection of all materials and equipment from damage, vandalism and theft. Storage areas shall be secured and screened so as to minimize visual impacts.

D.1.4 Equipment Maintenance

D.1.4.1 Design Builder shall maintain equipment and systems as recommended by the manufacturer and in accordance with Good Industry Practice throughout the Project until achieving Final Completion.

D.1.5 Restrictions on Use of Hazardous Substances

D.1.5.1 Unless otherwise expressly required or permitted under this DBA, Design Builder shall not install, use or store on the Lands or adjacent property any materials, equipment or apparatus, the installation, use or storage of which is likely to cause or in fact causes the generation, accumulation or migration of any Hazardous Substance in contravention of any Applicable Law. Without limiting the generality of the foregoing, Design Builder shall not use the Lands to dispose of, handle or treat any Hazardous Substances, in a manner that would cause the Lands, or any adjacent property, to become a contaminated site under Applicable Law.

D.1.6 Utilities

D.1.6.1 Design Builder is responsible for all Utility Company fees, capital and operating costs (including electricity, natural gas, street lighting, communications and water and sewer) during the Project Term.

D.1.6.2 In consultation and coordination with the City, Design Builder shall make all arrangements necessary to secure:

(a) communications systems, except internet, with Bell-MTS (copper and fibre optic);

(b) natural gas services with Manitoba Hydro; and

(c) all other utilities required to operate and maintain the Infrastructure.

D.1.7 Construction Commencement Conditions

D.1.7.1 Design Builder shall not commence any construction before satisfying each of the following conditions (the "**Construction Commencement Conditions**"):

(a) Design Builder will have obtained and submitted to the City current certificates of insurance for all required insurance in accordance with Schedule 11 – Insurance Requirements, and will have certified that all such policies are in full force and effect and in compliance with the requirements of this DBA;

(b) Design Builder has completed the temporary construction access in accordance with Section D.5.1;

(c) Design Builder will have submitted the following Submittals for review by the City in accordance with Schedule 5 – Review Procedure and obtained an endorsement of "Received" in relation to each Submittal:

(i) the Construction Quality Management Plan as described in Section B.6.1.4;

(ii) the Construction Management Plan as described in Section D.2.1.1;

(iii) geotechnical and hydrogeological design reports as described in Section C.7.4; and

(iv) the Excavation, Shoring and Dewatering Plan as described in Section C.3.5 of this Schedule;

(d) Design Builder shall submit all Pre-Construction Condition Assessment Reports in conformance with Section D.6.2.3;

(e) Design Builder shall satisfy all requirements of Applicable Law with respect to the commencement of construction and shall obtain all Permits, Licences and Approvals required for the commencement of the construction and all such Permits, Licences and Approvals shall be in full force and effect;

(f) Design Builder shall submit and achieve an endorsement of "Received" on the 90% Design Submittal construction package Design Builder intends on constructing;

(g) Design Builder shall submit and achieve an endorsement of "Received" on any applicable special studies and models as described in Schedule 18 Appendix 18K – Special Studies and Models, related to the construction package Design Builder intends on constructing; and

(h) Design Builder shall submit and achieve an endorsement of "Received" on any applicable Tie-in or Shutdown Work Plan as described in Schedule 18 Appendix 18P – Coordination Protocol, related to the construction package Design Builder intends on constructing.

D.1.7.2 Mobilization/Demobilization

D.1.7.2.1 Mobilization shall not commence prior to the Effective Date.

D.1.7.2.2 Design Builder shall meet the following criteria to be authorized for Mobilization:

(a) finalized design for the temporary works including temporary utilities, site offices, site access as part of the 60% Design Submittal for civil works as outlined in Schedule 18 – Technical Requirements Appendix 18N – Design Submittal Requirements and endorsed "Received" in accordance with Schedule 5 – Review Procedure;

(b) an endorsement of "Received" in accordance with Schedule 5 – Review Procedure on the following:

(i) Community Impact Mitigation Management Plan;

(ii) Emergency Response Plan;

(iii) Environmental Management Plan; and

(iv) Health, Safety and Security Management Plan (second submission).

D.1.7.2.3 Demobilization shall be complete prior to Final Completion.

D.1.8 Environmental Management

D.1.8.1 Design Builder shall submit an Environmental Management Plan as set out in Section D.2.4.

D.1.8.2 Design Builder shall have a management system to provide an organizational structure, procedures, processes and resources necessary to implement a comprehensive, planned and systematic program, pursuant to this Design Build Agreement, to ensure that environmental legislative requirements and environmental Permits, Licences and Approvals required by this Design Build Agreement are achieved by Design Builder in every material aspect (the "**Environmental Management System**").

D.1.8.3 Design Builder shall implement and follow the Environmental Management System throughout all stages of the Works.

D.1.8.4 While ISO certification is not mandatory, the Environmental Management System shall be consistent with the requirements of ISO 14001:2015 and all subsequent revisions and shall address all stages of the Works in accordance with the Design Build Agreement.

D.1.8.5 All records from the Environmental Management System, including all audits, shall be maintained and retained by Design Builder for the duration of the Project Term or until otherwise agreed to in writing by the City Representative.

D.1.8.6 Design Builder shall make all Environmental Management System records available to the City for inspection and review. Design Builder shall provide the City with a copy of any or all quality records when requested.

D.1.8.7 The Environmental Management System shall require all Design Builder Parties be contractually obligated to adhere to the Environment Management Plan and meet the Technical Requirements.

D.1.9 Lands and Existing Infrastructure

D.1.9.1 Design Builder is responsible for ensuring that the Lands and Existing Infrastructure is adequately protected from damage due to the Work.

D.1.9.2 Design Builder is responsible for all debris, roadway deterioration, deterioration of the Existing Infrastructure or Lands, pothole maintenance and mechanical

leaks and spills during the Project Term that are caused by Design Builder or if Lands or Existing Infrastructure deterioration was accelerated due to Design Builder's activities.

D.1.9.3 Design Builder shall inspect the Lands and Existing Infrastructure with the City in accordance with Section D.6.2 of this Schedule 18.

D.1.9.4 Subject to the Work, Design Builder shall restore the Lands and Existing Infrastructure to equal or better condition prior to Final Completion.

D.1.9.5 Existing Utilities and Services

D.1.9.5.1 Design Builder shall:

(c) confirm the location of and protect all existing on-site utilities and services that may be affected by the construction; and

(d) relocate any existing on-site utilities and services that conflict with the construction and comply with all requirements of Governmental Authorities and utility suppliers.

D.1.9.5.2 An internet connection is available in the Administration Building, however, Design Builder shall provide the needed equipment and networking to provide internet services in the Infrastructure, as required by the DBA.

D.1.9.5.3 Design Builder shall be responsible for:

(a) coordinating and assisting the City in obtaining any easements;

(b) constructing all connections and making any necessary provisions at the Lands, to accept the off-site utilities onto the Lands;

(c) construction of off-site utilities in accordance with the requirements identified in the Technical Requirements; and

(d) all utility trench restoration, utility relocations and roadway restoration as part of the off-site utility installation.

D.1.9.6 Design Builder shall:

(a) construct the Infrastructure within the locations and boundaries identified in Schedule 12 – Lands, Site(s) and Facility(ies);

(b) install fencing around the perimeter of work areas and such hoarding as may be required to separate the work areas from the public and plant staff;

(c) maintain excavation shoring and dewatering systems in a safe manner in accordance with all Applicable Law; and

(d) maintain good housekeeping and general cleanliness during the construction period.

D.1.9.7 Design Builder shall be only be permitted to access the Construction Lands from Highland Avenue through the Staging Area Lands.

D.1.10 Laydown and Staging Areas

D.1.10.1 The City will provide the Construction Lands and Staging Area Lands, identified in Schedule 12 – Lands, Site(s) and Facility(ies), for laydown and staging areas, subject to the following conditions:

(a) laydown and staging areas shall not encroach on any part of the existing facilities or existing roadways that are used for City Operations;

(b) laydown and staging areas shall not disrupt City Operations or alter the ability of plant staff to perform daily operations; and

(c) laydown and staging areas shall not encroach on public spaces.

D.1.10.2 Design Builder shall be responsible for obtaining any additional laydown and staging areas necessary for the performance of construction, including securing all property rights necessary for such areas, all at Design Builder's cost and expense.

D.1.10.3 All laydown and staging areas must be maintained by Design Builder in an orderly manner throughout construction and must be restored by Design Builder to their pre-existing condition or better following construction of the Infrastructure and as a condition of Final Completion, except those items listed in Section D.9.1.2.

D.1.11 Adjacent Business and Residential Property

D.1.11.1 Design Builder is responsible for ensuring that all adjacent businesses and residential properties are adequately protected from damage due to the Work.

D.2 Construction Management Plans

D.2.1 General

D.2.1.1 The construction management plans described in this Section D.2 shall form part of Schedule 4 – Design Builder's Management Systems and Plans. Updated and revised plans shall supersede previous versions.

D.2.1.2 The construction management plans, including any updated and revised plans, shall be reviewed in accordance with Schedule 5 – Review Procedure.

D.2.1.3 Design Builder shall revise and update the construction management plans as required to reflect any changes to the management of the construction of the Infrastructure. Design Builder shall, at a minimum, provide the City with an annual update to the construction management plans.

D.2.2 Construction Management Plan

D.2.2.1 Design Builder shall develop and submit a plan in accordance with Schedule 5 - Review Procedure for managing the construction (the "**Construction Management Plan**") that includes:

(a) comprehensive methodology that Design Builder will adopt to manage the construction and ensure it complies with the Technical Requirements and Issued for Construction Documents;

(b) communication protocols and procedures for the integration of the design and construction processes;

(c) scope verification procedures and quality control procedures in coordination with the Construction Quality Management Plan;

(d) resource planning and management procedures;

(e) construction schedule monitoring, updating and control processes;

(f) a description of the means and methods for maintaining access to the Lands in accordance with this DBA;

(g) a description of the means and methods to identify long-lead items and the management of logistics. Design Builder shall demonstrate that an experienced and skilled team will be used for procurement and logistics management;

(h) plans and procedures to manage construction access routes for construction traffic and equipment and material deliveries during construction;

(i) plans and procedures to manage the stockpiling and hauling off-site of excavated material;

(j) plans for supply of concrete and whether Design Builder intends to have a dedicated batch plant either on or off the Lands;

(k) plans and procedures to manage Lands security including fencing, manned gates, lighting, incident reporting and controlled site access;

(l) plans and procedures to manage emergency responses, including how the plan and procedures integrate with the existing NEWPCC emergency response plan;

(m) a description of the construction staging, employee and trailer parking areas, food truck service locations, and employee changing and break areas;

(n) plans and procedures for construction in physically congested areas;

(o) a plan for the coordination of the construction with the Related Projects;

(p) communication and notification protocols for both routine and emergency conditions;

(q) construction procedures to ensure compliance with all Applicable Law;

(r) procedures for topsoil handling and conservation, including storage, replacement and rutting and compaction prevention;

(s) plans and procedures to ensure proper workmanship and maintain quality for construction activities performed during winter months;

(t) procedures for dust and odour control management on the Lands and adjacent to the Lands;

(u) a noise management plan that includes:

(i) procedures to limit noise levels at the boundary of the Lands to a maximum of:

(A) 85 dBA between the hours of 7:00 a.m. and 9:00 p.m. on weekdays;

(B) 85 dBA between the hours of 9:00 a.m. and 9:00 p.m. on weekends and statutory holidays; and

(C) 65 dBA at all other times during the 24-hour day;

(ii) procedures and strategies for noise attenuation, noise barriers, and other techniques to:

(A) ensure compliance with requirements of all Governmental Authorities and this DBA; and

(B) minimize noise impacts to persons present on the Lands in accordance with Good Industry Practice;

(iii) procedures for monitoring noise levels at the boundary of the Lands; and

(iv) training for employees and subcontractors to identify and monitor activities that may result in a noise incident;

(v) wildlife management strategies;

(w) procedures for vegetation (including trees, shrubs, vines, grasses and topsoil) clearing, establishment and management (including weed control);

(x) procedures for watercourse crossings, including in-water activities;

(y) spill prevention and response plans;

(z) procedures to drain tanks, conduits and piping such that no untreated or partially treated wastewater or sludge is discharged to the environment. All untreated or partially treated wastewater or sludge shall be returned to the appropriate plant process for treatment;

(aa) procedures to address groundwater protection, erosion prevention and sediment control, including the requirements for control of any construction water and land drainage, including applicable permits;

(bb) care of water plans, including land drainage management, groundwater management, surface water management and dewatering and drainage management;

(cc) procedures for the continuous monitoring of surface water to ensure that any surface water contamination does not go undetected;

(dd) plans and procedures for fuel storage and equipment maintenance;

(ee) construction waste management procedures and plans, including identification of opportunities for reduction, reuse and recycling of materials, and the designated landfill for residual trash. Include an analysis of the proposed waste expected to be generated, together with types and quantities; and

(ff) hazardous waste management procedures, including handling and disposal training requirements for Design Builder Parties.

D.2.3 Community Impact Mitigation Management Plan

D.2.3.1 Further to Section E14 of the DBA, Design Builder shall develop and implement a plan for minimizing the impact of construction for the surrounding community including small businesses (the "**Community Impact Mitigation Management Plan**") that includes:

(a) clearly identifying activities that may impact the public, including a description of the nature, timing and extent of the effect, and the steps Design Builder intends to take to minimize the extents and impacts of such effects;

(b) approach to minimize disruption to public traffic;

(c) approach to minimize odour during construction;

(d) approach to minimize noise and vibration;

(e) approach to prevent draw-down of wells used by the surrounding community including small businesses;

(f) approach to minimize negative air quality impacts from dust, smoke and

diesel emissions;

(g) approach for storage of equipment, materials, soil and gravel;

(h) approach for street cleaning;

(i) approach for site cleanliness and visual impact mitigation;

(j) attending to excessive street parking near site;

(k) plans and procedures for restoration of the lands;

(l) approach to eliminate or treat standing water that may allow mosquito breeding;

(m) approach to safe and healthy practices to maintain public safety; and

(n) approach to supporting the City in its public outreach program including:

(i) supply of outreach material and attendance at quarterly public meetings to present Project information and respond to questions; and

(ii) supply of outreach material for the City's active Project website that will provide project information, general status of the work and a forecast of planned activities for the next 60 days, updated each month.

D.2.4 Environmental Management Plan

D.2.4.1 Design Builder shall develop Environmental Management Plan that meets the requirements of Section D.1.8 of this Schedule 18 and includes (the "**Environmental Management Plan**"):

(a) a statement of goals and/or objectives to ensure environmental protection and promote continuous improvement;

(b) measurable environmental management targets, timeliness and resources to meet these targets;

(c) the approach and procedure to identify and comply with applicable federal, provincial and municipal environmental legislation and Permits, Licences and Approvals including a description of:

(i) the scoping of the monitoring/and/or inspection programs;

(ii) frequency of inspection and/or monitoring events and rationale for frequency;

(iii) listing of applicable performance requirement criteria (may include legislative requirements);

(iv) methodologies; and

(v) reporting;

(d) the approach to and process for integrating environmental management requirements and/or standards for the Project into individual Design Builder Parties' execution of the WBS packages;

(e) procedures to ensure all Design Builder Parties' personnel:

(i) have adequate knowledge of the Environmental Management Plan appropriate to complete Work with the potential to cause environmental impacts;

(ii) receive appropriate education or training prior to completing Work with the potential to cause environmental impacts; and

(f) how the performance of the Environmental Management System is being monitored and at what frequency. This shall include auditing in accordance with Section B.6.5, control of Non-Conformances in accordance with Section A.4, and corrective and preventative actions.

D.2.5 Remediation Management Plan

D.2.5.1 Design Builder shall develop a comprehensive plan (the "**Remediation Management Plan**") that sets out the details for Design Builder's remediation of the Environmental Damage or Degradation and any contamination identified in the course of the investigations required under Section D.4.6, including:

(a) remediation schedule;

(b) design of remedial excavations, including area, depth and sequence;

(c) excavation geotechnical stability;

(d) soil disposal plan for safe disposal of all contaminated soil in accordance with Applicable Law;

(e) a Groundwater Management Plan in accordance with Appendix 18B – Specifications for:

(i) protecting uncontaminated groundwater and surface water;

(ii) remediating contaminated groundwater and surface water;

(iii) performing groundwater dewatering from excavations based on professional hydrogeological calculations; and

(iv) measures that will be undertaken during construction to prevent the ingress of groundwater (including contaminated groundwater) onto the Lands from off site and the egress of groundwater

(including contaminated groundwater) from the Lands to off site, together with supporting documentation including data from field investigations, reports, calculations, modelling and other activities consistent with good industry practice to demonstrate such measures will be effective;

(f) means and methods by which Design Builder will remediate Lands including remediation of:

(i) asbestos;

(ii) lead-based paint;

(iii) mercury switches;

(iv) used oil;

(v) used chemicals; and

(vi) polychlorinated biphenyls.

D.2.5.2 Design Builder shall submit the Remediation Management Plan in accordance with Schedule 5 – Review Procedure.

D.2.6 Health, Safety, and Security Management Plan

D.2.6.1 Design Builder shall have a "**Health, Safety, and Security Management Plan**" incorporating the requirements of Section D.7. The Health, Safety, and Security Management Plan shall be submitted in two phases.

D.2.6.2 The first phase shall include the following:

(a) identification of all hazards associated with the Work;

(b) details of all safe work procedures designed to avoid or mitigate hazards;

(c) Design Builder's corporate health and safety policy, stating corporate commitment and objectives for health and safety management. Design Builder to demonstrate that its health and safety policy and plan meets or exceed the City's safety standards in Project Background Information;

(d) the overall strategy for work zone safety, including guiding principles and standards for work zone plans;

(e) details regarding hygienic work in a sewage treatment plant;

(f) details regarding site clean-up and restoration;

(g) the procedure for accident reporting and investigation, including fulfillment of the specific requirements of WSHA and its associated regulations;

(h) the procedure for reporting accidents related to the Work to the City at the time of occurrence, in a monthly summary, and in a yearly summary;

(i) a policy for workplace health and safety meetings and inspections;

(j) the health and safety committee provisions as required by the WSHA and its associated regulations;

(k) the designation and naming of a health and safety manager who will conduct and document audits on site to confirm compliance to the Health, Safety, and Security Management Plan;

(l) the roles and responsibilities of Design Builder's key safety management personnel;

(m) procedures to ensure that all Design Builder Parties have the requisite health and safety training and certifications including training for job-specific methods and specific equipment instructions;

(n) descriptions of Design Builder's safety training programs;

(o) descriptions of Design Builder's accident prevention programs; and

(p) the processes and procedures for planning, performing, reporting and closing out safety audits.

D.2.6.3 The second phase of the Health, Safety, and Security Management Plan shall be submitted within 180 Calendar Days of the Effective Date, or before Design Builder mobilizing to site, whichever is earlier, and shall include the following:

(a) the safe work procedures to be followed, specific to the construction activities required for the Project;

(b) a detailed assessment of any hazardous materials Design Builder may encounter during the Works and the proposed methods of Work related to the Hazardous Substances. At a minimum, the hazardous materials to be dealt with shall include asbestos, lead, polychlorinated biphenols and other regulated hazardous materials typically found in wastewater treatment plants of similar vintage;

(c) safety and security procedures to ensure the tenants of 1430 Gibbs Street will have safe access to the building, while ensuring Design Builder's property on the Staging Area Lands remains secure. Include drawings showing safe travel route; and

(d) safety procedures to ensure that the City Representative and City Parties will have safe access to the site office. Include drawings showing safe travel route.

D.2.6.4 Design Builder shall update the Health, Safety, and Security Management Plan at least once per year and as Design Builder recognizes changes in the Work,

site requirements, workforce requirements, Applicable Law and regulations, or other items, or as directed by the City to make certain changes as the City believes are necessary to provide safe and healthy Lands and work environment. Design Builder shall submit any Plan updates for review in accordance with Schedule 5 – Review Procedure. Once a "Received" endorsement is received from the City, the updated Health, Safety, and Security Management Plan shall supersede and replace the existing Health, Safety, and Security Management Plan.

D.2.7 Emergency Response Plan

D.2.7.1.1 Design Builder shall have an emergency response plan (the "Emergency Response Plan"). The Emergency Response Plan shall include:

(a) the manner and timing of reaction to emergencies to ensure public safety and the protection of property;

(b) the activation process for mobilizing crews at short notice in the event of emergencies;

(c) a contingency plan in the event that primary staff cannot be reached;

(d) the training to be given to staff with respect to emergency response procedures;

(e) communication strategies with the City, utility companies, police and fire department;

(f) an administrative process to collect the costs of accidents and incidents from the responsible parties;

(g) a description of the procedures for prompt replacement and repair of Works or Infrastructure due to accident damage;

(h) the methods and procedures for debris removal; and

(i) specific emergency response measures as required by any applicable Governmental Authority, Applicable Law, City Standards or Permits, Licenses and Approvals.

D.2.8 Design Builder's Maintenance Management Plan

D.2.8.1 Design Builder shall prepare and submit a maintenance plan ("**Design Builder's Maintenance Management Plan"**). The Design Builder's Maintenance Management Plan shall describe how Design Builder will protect and maintain the Works from the time of construction until Final Completion, in accordance with Section D.10.3. The Design Builder's Maintenance Management Plan shall include, at a minimum;

(a) list of the facilities that will require protection from the elements;

(b) method to protect the Infrastructure and its equipment from the elements;

(c) number of years or months that each component of the Infrastructure will require protection;

(d) methods for inspection, assessment and monitoring for damage or potential damage to the Works;

(e) maintenance activities required for installed equipment;

(f) maintenance schedule required for installed equipment; and

(g) record-keeping for performing maintenance activities.

D.2.8.2 Design Builder shall submit the maintenance records within 60 Calendar Days of Final Completion.

D.3 Additional Construction Plans

D.3.1 Construction Mitigation Plans

D.3.1.1 Design Builder shall:

(a) for each Existing Condition identified in the assessments described in Section D.6.2 as being potentially vulnerable to damage or other adverse impacts arising from the design, the construction or the operation of the Infrastructure, prepare and implement a work plan (the "**Construction Mitigation Plan**") that sets out, in detail satisfactory to the City acting reasonably, the relevant information from the assessments. Such Construction Mitigation Plan to be sealed by the Engineer of Record, where such plan contains any design documents for permanent methods, measures or procedures;

(b) use all reasonable efforts to obtain the written approval of the relevant provisions of the Construction Mitigation Plan from the owner(s) of the applicable property, building, structure or other object identified in the Existing Condition. Notwithstanding the foregoing, Design Builder shall obtain the written approval of the relevant provisions of the Construction Mitigation Plan from the owner(s) of any object identified in the Existing Condition that Design Builder proposes to relocate, modify, reconstruct, decommission or abandon; and

(c) submit the Construction Mitigation Plan, together with the written approvals required under Section D.3.1.1(b), to the City for review in accordance with Schedule 5 – Review Procedure at least 30 Business Days before commencing any construction activities.

D.3.2 NEWPCC Fire Safety Plan

D.3.2.1 The City has an existing fire safety plan for the NEWPCC facility (the **"NEWPCC Fire Safety Plan"**);

D.3.2.2 Design Builder shall support City in the update of the NEWPCC Fire Safety Plan to incorporate the Infrastructure by:

(a) updating existing site plan drawings to reflect changes to the NEWPCC facility including new fire hydrant locations, risers, egress pathways, and confined spaces;

(b) creating drawings for the new facilities and creating new drawings for reused facilities, using similar drawing style and symbology to the existing emergency response plan drawings, for inclusion into the emergency response plan. Drawing content to include egress pathways, fire extinguishers, pull stations, and audible devices; and

(c) providing other information as may be applicable to the emergency response plan.

D.4 Site Conditions

D.4.1 Geotechnical

D.4.1.1 Design Builder assumes all risk related to geotechnical and groundwater conditions encountered during design and construction.

D.4.1.2 Design Builder shall use the services of a qualified geotechnical engineer and hydrogeologist to evaluate geotechnical and groundwater conditions at the Lands during construction and provide advice as conditions dictate.

D.4.2 Buried Utilities and Services

D.4.2.1 Design Builder is responsible for locating and verifying all buried services, such as buried piping and electrical conduits.

D.4.2.2 Design Builder shall use soft excavation methods (hydrovac) whenever it is excavating within 3 metres of buried services, or suspected buried services, to expose the perimeter of any excavations. Any slurry generated as part of the soft excavation (hydrovac waste) shall be removed and disposed of off-site in accordance with Applicable Law.

D.4.3 Reuse of Existing Infrastructure

D.4.3.1 If Design Builder chooses to reuse Existing Infrastructure, Design Builder shall be responsible for determining the condition and reusability of the Existing Infrastructure. Design Builder shall not rely upon documentation provided by the City. Design Builder shall use the services of a qualified Professional of Record to identify any modifications or upgrades, to meet current codes, which are required to reuse Existing Infrastructure.

D.4.4 Environmental Contamination

D.4.4.1 Design Builder shall collect, store and dispose off-site, in accordance with Applicable Law, all Hazardous Substances encountered during the execution of the Works, including material exposed during decommissioning.

D.4.5 Contaminated Sites Approved Professional

D.4.5.1 Design Builder shall retain a qualified environmental consulting engineering firm to manage and oversee Design Builder's obligations under Section D.4.4, including:

(a) conducting the investigations set out in Section D.4.6 and any other required investigations of the Lands;

(b) preparing any required plans (including the Remediation Management Plan), reports, permits, regulatory forms or documentation required to manage contaminated soil and groundwater; and

(c) obtaining all applicable Permits, Licences and Approvals, including a Certificate of Compliance.

D.4.6 Site Condition Investigations

D.4.6.1 Design Builder shall conduct environmental investigations, as deemed necessary by Design Builder, of the soil and groundwater in the Lands to:

(d) delineate the nature and extent of soil and groundwater contamination on the Lands;

(e) identify soil concentration categories and volumes necessary for landfill disposal;

(f) identify groundwater quality concentration categories and flow volumes necessary to obtain water disposal Permits, Licences and Approvals;

(g) design, install and operate any required groundwater treatment works; and

(h) dispose of any contaminated soil.

D.4.7 Removal or Use of Fill Material

D.4.7.1 As part of its remediation of the Environmental Damage or Degradation;

(a) Design Builder shall excavate and remove all contaminated fill material from the Lands to facilitate the construction of Design Builder's Design; and

(b) Design Builder may leave existing fill material in place at the Lands, or use existing fill material at the Lands, only if Design Builder has tested the

fill material, confirmed that the fill material meets the applicable standards set out in *Contaminated Site Remediation Regulation* (Manitoba).

D.4.8 Remediation

D.4.8.1 Design Builder shall submit a Remediation Management Plan as set out in Section D.2.5.

D.4.8.2 Further to Section D4 of the DBA, Design Builder shall remediate all Environmental Damage or Degradation in accordance with the Remediation Management Plan and the requirements of Applicable Law and Governmental Authorities. In undertaking such remediation, Design Builder shall:

(a) remediate all contaminated soil and soil vapour to meet the applicable standards set out in the *Contaminated Site Remediation Regulation* (Manitoba) or load, transport away from the Lands and dispose of contaminated soil in accordance with Applicable Law;

(b) with respect to groundwater and surface water:

(i) remediate water to the applicable standards set out in the *Contaminated Site Remediation Regulation* (Manitoba) including applicable reporting, permitting, and monitoring;

(ii) take reasonable measures to prevent the ingress of water onto the Lands and treat contaminated water before disposal; and

(iii) monitor the effectiveness of such measures during construction and take corrective action if such monitoring shows the measures are not effective;

(c) remediate to the applicable standards including applicable reporting, permitting, and monitoring other Hazardous Substances including:

(i) asbestos;

(ii) lead-based paint;

(iii) mercury switches;

(iv) used oil;

(v) used chemicals; and

(vi) polychlorinated biphenyls.

D.4.9 Confirmation of Remediation Sampling

D.4.9.1 Design Builder shall conduct confirmation of remediation sampling and testing in conformance with the *Contaminated Sites Remediation Regulation* (Manitoba)

and “Technical Guidance” documents published by Manitoba Sustainable Development in respect of contaminated sites, including:

(a) soil sampling of excavation sides and bottom;

(b) groundwater and surface water (including precipitation into open excavations in area of contaminated soil) sampling;

(c) soil vapour sampling;

(d) sampling of other Hazardous Substances including:

(i) asbestos;

(ii) lead-based paint;

(iii) mercury switches;

(iv) oils and hydrocarbons;

(v) chemicals; and

(vi) polychlorinated biphenyls.

D.4.10 Certificate of Compliance

D.4.10.1 Promptly upon completion of the remediation and remediation sampling of the Lands, Design Builder shall apply for and obtain from Manitoba Sustainable Development a Certificate of Compliance, with conditions reasonably satisfactory to the City, that confirms that the Lands (including soil, groundwater, vapour, and Hazardous Substances) have been remediated to meet the standards required by the Remediation Management Plan and by Applicable Law for the construction, operation, use and occupation of the Infrastructure.

D.5 Temporary Works

D.5.1 Temporary Construction Access

D.5.1.1 For a temporary construction access, Design Builder shall:

(a) provide the temporary construction access via Highland Avenue;

(b) realign a portion of Highland Avenue near the intersection with Main Street subject to the following conditions:

(i) the new alignment shall accommodate eastbound and westbound through traffic between Chief Peguis Trail and Highland Avenue;

(ii) the new alignment shall be built to the same standards as a “Residential Lane”, in accordance with the *City of Winnipeg Transportation Standards Manual*;

(iii) the new alignment shall be, as a minimum, constructed with a gravel surface, except in the area of the vehicle detector loops, which shall be, as a minimum, constructed with an asphalt surface;

(iv) the existing alignment shall not be closed until the new alignment is open and ready for traffic;

(v) signage is used to direct the public along the new alignment;

(vi) construction of the new alignment shall not commence until Design Builder's 90% Design Submittal has been endorsed "Received"; and

(vii) Design Builder provides notice to the City at least 20 Business Days prior to when the new alignment will be put into service;

(c) coordinate with the City to install vehicle detector loops for eastbound traffic on Highland Avenue at the new temporary west leg of the intersection;

(d) modify the intersection to allow for the following new traffic movements:

(i) westbound Chief Peguis Trail onto westbound Highland Avenue (through traffic);

(ii) eastbound Highland Avenue onto eastbound Chief Peguis Trail (through traffic);

(iii) eastbound Highland Avenue onto southbound Main Street (right turn);

(iv) eastbound Highland Avenue onto northbound Main Street (left turn); and

(v) southbound Main Street onto westbound Highland Avenue (right turn).

(e) restrict the construction activity for the temporary construction access to the Highland Signalization Site or the Staging Area Lands as defined in Schedule 12 – Land(s), Site(s) and Facility(ies).

D.5.1.2 No left turn shall be made from northbound Main Street onto westbound Highland Avenue (traffic will be required to perform a U-turn further north of the intersection and approach Highland Avenue from southbound Main Street).

D.5.2 Project Signage

D.5.2.1 Site Signage

D.5.2.1.1 Design Builder may erect a large sign at the site entrance, provided it

meets the City's bylaws and regulations, advertising the site and all project participants. The media format, size and layout will be subject to City approval. Design Builder shall allow space for the City of Winnipeg, Veolia, AECOM and Stantec logos within the layout. All logos and text shall meet the USSC Standard Legibility Index requirements.

D.5.2.1.2 Design Builder shall, at the request of the City, erect signage provided by the Province or the Government of Canada as applicable.

D.5.2.1.3 Any Design Builder signage shall not be larger in size than the sign at the Main Street entrance, advertising the NEWPCC name and address.

D.5.3 Office Facilities

D.5.3.1 During construction, Design Builder shall:

(a) have the sole responsibility for the design, erection, operation, maintenance and removal of all temporary office facilities, including temporary structures and other temporary facilities and the design and execution of construction methods required in their use;

(b) provide all utilities necessary for construction, including electricity, natural gas, telephone, cable, internet, water and sanitary facilities. Design Builder may utilize permanent utilities once they are connected pursuant to Section D.1.6; however, Design Builder shall be responsible for the sub-metering and payment of all utility bills incurred by Design Builder until Substantial Completion;

(i) Design Builder may use the existing utilities, provided Design Builder can demonstrate, to the satisfaction of the City, that such use will not adversely impact City Operations. However, Design Builder shall sub-meter all utilities, and shall reimburse the City at the City's current rate paid to the utility;

(c) provide a trailer type mobile field office in a location on the Staging Area Lands and within 100 metres of the Design Builder's trailer complex, for the City's use, such office shall have at least 265 square metres floor space and the following features:

(i) lockable doors and windows, electrical power, heating and air conditioning, lighting, first aid kit, 7 separate incoming/outgoing telephone lines, internet service with a wireless router, potable hot and cold water supply, sanitary sewer and fire extinguisher;

(ii) 6 private offices with suitable office furniture (all in new condition) including desks, chairs, telephone and lockable file cabinets. Office sizes shall be approximately 3.7 m by 3.7 m;

(iii) space for an additional 5 staff with suitable office furniture (all in new condition) including desks, chairs, and lockable file cabinets;

(iv) 1 colour photo copier/printer/scanner machine (capable of handling 11” x 17” originals);

(v) 1 drawing layout tables, suitable to lay flat 2 sheets of A1 paper size side-by-side;

(vi) 1 separate room for large conference table suitable to accommodate 12 people including chairs, conference telephone and audio/visual equipment;

(vii) separate male/female washroom facilities;

(viii) lunchroom/kitchenette facilities including table and chairs, sink, cupboards, coffee maker, kettle, refrigerator and microwave oven; and

(ix) a “City of Winnipeg” sign on the front wall of the trailer; and

(d) maintain the mobile field office including outdoor housekeeping, snow removal, and sanding/de-icing. For clarity, the City will be responsible for indoor housekeeping services for the site office.

D.5.4 Temporary Parking Facilities

D.5.4.1 During construction, Design Builder shall:

(a) provide electrified parking spaces adjacent to the temporary office facilities for 11 vehicles; and

(b) provide replacement parking spaces for any existing parking spaces that were removed from service as a result of Design Builder’s construction activities.

D.6 Construction Documentation

D.6.1 Construction Reports

D.6.1.1 Design Builder shall be responsible for preparation of weekly construction reports that detail:

(a) the overall progress of the work including photographs. Photographs can be included in the report, as applicable; however, all photographs shall be submitted in accordance with Section D.6.3;

(b) any special installation requirements needed for the work;

(c) any hazardous materials encountered and how they were remediated on-site or removed from site;

(d) overall progress of the schedule;

(e) any Non-Conformances related to the construction;

(f) any unusual on-site circumstances encountered;

(g) the number of Design Builder staff members on-site;

(h) any safety and health incidents, including near misses; and

(i) listing of any high-risk activities.

D.6.2 Assessments

D.6.2.1 Identification of Zones of Influence

D.6.2.1.1 Design Builder shall as be responsible for:

(a) identifying each Existing Condition whether or not such Existing Condition is disclosed in Project Background Information or in any office of public record;

(b) identifying any and all potential damage and other adverse impacts on any Existing Condition, including:

(i) deformations or damage resulting from static or vibratory loads, or deformations resulting from changes in groundwater pressures or groundwater drawdown;

(ii) cracking of slabs, pavements, walls, utilities, rail lines, or other facilities;

(iii) modification of surface or underground drainage patterns;

(iv) impacts on wells and aquifers and other effects arising from changed groundwater conditions;

(v) increased stresses on underground structures and utilities;

(vi) removal of support from surface supported structures, or buried utilities or structures; and

(vii) any potential conflicts between any Existing Condition and the Infrastructure design or construction;

(c) defining the area (the "**Zone of Influence**") that contains:

(i) Existing Conditions located within the Lands, within 50 metres of the Lands or any other Existing Conditions that may be impacted by the construction; and

(ii) any other Existing Conditions that the City may reasonably request.

D.6.2.1.2 Without limiting the generality of the foregoing, Design Builder shall:

(a) identify the Zone of Influence and all Existing Conditions within the Zone of Influence;

(b) set out the results of Design Builder's analysis regarding ground deformations (both horizontal and vertical) anticipated by Design Builder as a result of the construction and the basis of the analysis, including:

(i) the key input criteria (including predicted deformations of shored wall, or resulting from groundwater control);

(ii) the basis for the selection of the key input criteria;

(iii) a description of the analysis methodology; and

(iv) any other information that Design Builder relied upon to support the analytical prediction.

D.6.2.1.3 In respect of each Existing Condition within the Zone of Influence, identify and assess the potential causes of damage or other adverse impacts arising from the design, the construction or the operation of the Infrastructure, including:

(a) the geotechnical and hydrogeological characteristics of the ground under and around the Existing Condition, as well as the test holes and geotechnical test parameters and values that were used for the evaluation of such characteristics;

(b) the proposed construction methodologies, including construction sequencing and equipment, that Design Builder proposes to use; and

(c) the ground displacements, vibrations and changes in groundwater conditions induced by the construction.

D.6.2.1.4 In respect of each Existing Condition within the Zone of Influence:

(a) identify the nature of the potential damage and other adverse impacts arising from the design or the construction, including any impacts set out in Section D.6.2.1.1(b);

(b) describe Design Builder's proposed temporary and permanent methods, measures and procedures (including accommodating, protecting, relocating, modifying, re-constructing, decommissioning and/or abandoning such Existing Condition) to prevent potential damage and other adverse impacts to such Existing Condition;

(c) if damage or other adverse impact to an Existing Condition is

unavoidable despite Design Builder's compliance with Good Industry Practice, identify the nature and extent of such impacts to the Existing Condition and describe Design Builder's proposed steps and measures:

(i) to repair the damage or mitigate the adverse impacts to such Existing Condition to a state equivalent to that which existed before the damage or other adverse impact; and

(ii) where it is not feasible to repair the damage or mitigate the other adverse impacts in accordance with Section D.6.2.1.4(c)(i) Design Builder may, with the prior written approval of the relevant owner(s):

(A) restore such Existing Condition to a state as close to comparable to that which existed before the damage or adverse impact; or

(B) relocate, modify, reconstruct, decommission or abandon such Existing Condition.

D.6.2.1.5 Identify the instrumentation that Design Builder proposes to utilize to monitor the Existing Conditions within the Zone of Influence to verify that actual conditions are within the predicted and tolerable limits permitted by this DBA, including at a minimum:

(a) the proposed type, location, installation method and data collection procedures (including monitoring frequency) of such instrumentation; and

(b) for each instrument:

(i) the action level or portions thereof for any settlement, lateral movement or strains, or other conditions as applicable; and

(ii) the specific actions that are to be taken at each such identified action level or portions thereof.

D.6.2.1.6 Design Builder shall submit Construction Mitigation Plans as described in Section D.3.1.

D.6.2.2 Pre-Construction Condition Assessments

D.6.2.2.1 At least 45 Business Days before the commencement of any excavation, dewatering, shoring, pile installation, or vibration-producing activity as part of the construction, Design Builder shall carry out comprehensive pre-construction condition assessment of each Existing Condition within the Zone of Influence (each a "**Pre-Construction Condition Assessment**"), including:

(a) include in each Pre-Construction Condition Assessment, as applicable, the following:

(i) where the assessment is in respect of a building:

(A) a visual inspection of the exteriors and interiors; and

(B) an assessment of the elevations of the basement and ground floor;

(b) a record of the state of the Existing Condition by means of video and photographs and, where an Existing Condition is a sewer, interceptor, or outfall, a closed-circuit television (CCTV) assessment of the system within the Zone of Influence;

(c) video condition assessment of streets and sidewalks, gravity sewers, interceptors, outfalls and drainage systems within the Zone of Influence. All images and videos shall be during well-lit mid-day periods or artificially illuminated conditions, and of sufficient resolution to identify surface damage and cracking, or displacement of existing infrastructure;

(d) notations, measurements and engineering sketches of any existing damage to the existing condition, including architectural, structural, cosmetic, plumbing or electrical damage; and

(e) identification of any equipment sensitive to vibration or movement located within or in respect of the existing condition.

D.6.2.2.2 Design Builder shall take all steps and measures necessary to ensure that each Pre-Construction Condition Assessment is undertaken in accordance with the requirements of this DBA and shall:

(a) clean interceptors, sewers, outfalls, and drainage pipes, within the Zone of Influence in preparation for assessment;

(b) use all reasonable efforts to obtain the prior approval of the owner(s) of the existing condition to undertake the Pre-Construction Condition Assessment; and

(c) provide the owner(s) and occupier(s) of each existing condition with the opportunity to attend during the course of the Pre-Construction Condition Assessment of such existing condition.

D.6.2.2.3 The City will be entitled to attend during the course of the Pre-Construction Condition Assessment of each Existing Condition and Design Builder shall provide a minimum of 5 Business Days advance written notice to the City of the timing and location of each such assessment at each Existing Condition.

D.6.2.2.4 Design Builder shall ensure that a Professional of Record, assumes responsibility for any Pre-Construction Condition Assessment involving any of the following aspects of Existing Infrastructure:

(a) civil;

(b) structural;

(c) architectural;

(d) geotechnical;

(e) hydrogeological;

(f) process/mechanical;

(g) HVAC/mechanical;

(h) electrical/automation; or

(i) any facility or equipment within the Lands.

D.6.2.3 Pre-Construction Condition Assessment Reports

D.6.2.3.1 At least 20 Business Days before the commencement of any excavation, dewatering, shoring, pile installation, or vibration-producing activity as part of the construction that may damage or affect an Existing Condition within the Zone of Influence, Design Builder shall prepare and submit a pre-construction condition report with respect to such Existing Condition (each a "**Pre-Construction Condition Assessment Report**"), that:

(a) summarizes all of Design Builder's assessment findings with respect of the pre-construction state of the Existing Condition;

(b) includes copies of all photographs and videos, including, as applicable, CCTV sewer system assessments, taken by Design Builder of the Existing Condition;

(c) includes Design Builder's intended approach for monitoring vibration so that Design Builder can control vibration to prevent damage to Existing Conditions;

(d) includes all data and other information collected by Design Builder regarding the Existing Condition, including the data and information required under this section; and

(e) is signed and sealed by the Professional of Record who assumed responsibility for the assessment of such Existing Condition.

D.6.2.4 Condition Assessments During Construction

D.6.2.4.1 If, at any time during construction, an Existing Condition is damaged or otherwise adversely impacted by the construction, Design Builder shall:

(a) promptly notify the City;

(b) as soon as practicable conduct a further assessment of such Existing Condition utilizing the same assessment procedures used for the Pre-Construction Condition Assessment of such Existing Condition; and

(c) within 5 Business Days of completion of such further assessment, submit to the City a report that:

(i) summarizes all of Design Builder's assessment findings with respect of the damaged or otherwise adversely impacted state of the Existing Condition;

(ii) includes copies of all photographs and videos taken by Design Builder of the Existing Condition, both before and after the damage or other adverse impact; and

(iii) includes all data and other information collected by Design Builder regarding the damage or other adverse impact of the Existing Condition.

D.6.2.5 Post–Construction Condition Assessments

D.6.2.5.1 Design Builder shall:

(a) carry out a comprehensive post-construction assessment of each Existing Condition within the Zone of Influence (each a "**Post-Construction Condition Assessment**") to identify any changes in the state of each Existing Condition as a result of the construction; and

(b) in undertaking the Post-Construction Condition Assessment of an Existing Condition utilize, at a minimum, the same assessment procedures used for the Pre-Construction Condition Assessment of such Existing Condition.

D.6.2.6 Post-Construction Condition Assessment Reports.

D.6.2.6.1 At least 30 Business Days before making application for a Substantial Completion, Design Builder shall, with respect to each Existing Condition within the Zone of Influence, prepare and submit a Post-Construction Condition Assessment report (each a "**Post-Construction Condition Assessment Report**") for review by the City in accordance with Schedule 5 – Review Procedure that:

(a) summarizes all findings with respect of the post-construction state of the Existing Condition, including a comparison of the pre- and post-construction states of the Existing Condition;

(b) includes copies of all photographs and videos, including CCTV sewer system assessments, taken by Design Builder of the Existing Condition following completion of construction; and

(c) includes all data and other information collected by Design Builder regarding the Existing Condition following completion of construction.

D.6.2.6.2 If in the course of a Post-Construction Condition Assessment Design Builder identifies any damage or other adverse impacts to an Existing Condition caused by the construction, Design Builder shall:

(a) in the applicable Post-Construction Condition Assessment Report, describe Design Builder's proposed temporary and permanent methods, measures and procedures to repair the identified damage or other adverse impacts and to prevent further damage or other adverse impacts; and

(b) undertake the repair and mitigation work described in the applicable Post-Construction Condition Assessment Report that has achieved a "Received" status, in accordance with Schedule 5 – Review Procedure.

D.6.3 Field Documents

D.6.3.1 Throughout the performance of the Works, Design Builder shall:

(a) maintain a minimum of two up-to-date sets of field documents, including the design drawings, specifications, equipment vendor shop drawings, construction drawings and other relevant documents;

(b) ensure such field documents are up to date with any field measurements and field construction changes and discrepancies and are never more than 7 Calendar Days behind the current state of design and construction; and

(c) maintain each set of such field documents in separate locations such that a disaster will not jeopardize both sets simultaneously.

D.6.4 Photography

D.6.4.1 Where photographs are required under this DBA, Design Builder shall ensure adequate natural or artificial light to identify the subject of the photograph and the subject of the photograph shall be in focus.

D.6.4.2 Design Builder shall use a camera with a resolution of at least 15 megapixels.

D.6.4.3 Any photograph submitted by Design Builder to the City shall be labelled YYYY-MM-filename, where the filename is a brief description of the subject of the photograph. The filetype shall be either .jpg or .png. Group photographs by month. Submit photographs on the 10th day of each month that encompasses the work completed in the previous month.

D.6.5 Time Lapse Requirements

D.6.5.1 Design Builder shall undertake a time lapse image of the upgrade site, for the duration of the Project, from a vantage point to provide an overall image of the site. If the site cannot be effectively imaged with a single camera location, multiple cameras shall be employed and maintained including removal of debris from lenses.

D.6.5.2 The sequence of images, in MOV file format or other format acceptable to the City, shall be submitted to the City within 60 Calendar Days after Substantial Completion.

D.6.5.3 Resolution shall be a minimum of 72 ppi in vertical and horizontal planes.

D.6.5.4 A minimum of one photograph shall be taken each day at approximately the same hour for the duration of the construction period.

D.6.6 Drone Use

D.6.6.1 Design Builder may use drones or other remotely controlled camera to take images or video of the site, pipes or tunnels in accordance with Applicable Law; and

D.6.6.2 Design Builder shall submit, to the City, all drone images and video upon written request by the City Representative.

D.7 Safety

D.7.1 General

D.7.1.1 Design Builder shall be solely responsible for safety from the Effective Date to the Final Completion Date, including the safety of all persons on the Lands and any other location where the construction is performed (whether on the Lands or other location lawfully or not), and shall comply with the requirements of Applicable Law, standards, codes, guidelines and Good Industry Practice.

D.7.2 Safety Plans

D.7.2.1 Design Builder shall ensure all safety policies and plans are adhered to, including but not limited to, all safety and policies and plans specifically set out in:

(a) the Workplace Safety and Health Act (Manitoba);

(b) the Health, Safety and Security Management Plan, as described in Section D.2.6 and endorsed by the City as "Received" in accordance with Schedule 5 – Review Procedure;

(c) the Emergency Response Plan as described in Section D.2.7 and endorsed by the City as "Received" in accordance with Schedule 5 – Review Procedure;

(d) the health and safety management system(s) subject to Design Builder's COR;

(e) any other health and safety control plan developed by Design Builder to meet the Technical Requirements, or as required by Design Builder's Management Plans and Systems, or to meet the requirements of any Governmental Authority, as endorsed by the City as "Received" in accordance with Schedule 5 – Review Procedure; and

(f) all requirements outlined in the City of Winnipeg Safe Work Plan requirements as shown in http://www.winnipeg.ca/matmgt/safety/default.stm.

D.7.2.2 Design Builder shall update safety policies and plans regularly during construction as necessary for the changes in work or sequence of work. As a minimum, Design Builder shall update plans and policies once per year.

D.7.3 Safety Certification

D.7.3.1 Certificate of Recognition ("**COR**")

D.7.3.1.1 Prior to Design Builder undertaking any of the Works, Design Builder shall ensure that each Design Builder Party that is a construction team member, has in place and maintains a COR for the portion of the Works for which such Design Builder Party is responsible. The COR must be valid for the specific health and safety management system(s) that are to be used for the Works.

D.7.3.1.2 Design Builder shall ensure that prior to the subcontractors listed in Schedule 6 – Subcontractors and Key Individuals performing construction services for the Project, subcontractor shall obtain and thereafter maintain a COR at any time such subcontractor is providing services for the Project.

D.7.3.1.3 Design Builder must ensure that each Design Builder Party's, and each subcontractor's COR registration is properly documented, and the City will assume no liability for errors or omissions by the COR registering agency in this regard.

D.7.3.2 Certification Equivalent to COR

D.7.3.2.1 If the Design Builder or a Design Builder Party that is a construction team member has construction safety certification from another jurisdiction

which the Design Builder considers to be equivalent to a COR, this alternate construction safety certification may be acceptable provided that:

(a) Design Builder demonstrates that the alternate certification is equivalent or better than COR; and

(b) Design Builder states their intention that the Design Builder or Design Builder Party that is a construction team member that has the alternate certification intends to obtain a COR within a reasonable timeframe.

D.7.3.3 "Small Employers' Certificate of Recognition" Unacceptable

D.7.3.3.1 A "small employers' Certificate of Recognition" (for employers with less than 10 employees) is not acceptable.

D.7.3.4 Temporary Letter of Certification

D.7.3.4.1 Prior to the commencement of its services on the Project, if a subcontractor has not obtained a COR, a valid Temporary Letter of Certification issued by the Construction Safety Association of Manitoba or the Manitoba Heavy Construction Association WorkSafely™ Program will be considered acceptable.

D.7.4 The Workplace Safety and Health Act and Prime Contractor Obligations

D.7.4.1 General

D.7.4.1.1 Design Builder and each Design Builder Party shall at all times comply with the provisions of the WSHA.

D.7.4.1.2 Design Builder shall, for the purposes of the WSHA and for the duration of the Project Term, do everything that is necessary to ensure the health and safety of all persons that are affected by Design Builder's activities on the Lands.

D.7.4.1.3 Design Builder shall direct all Design Builder Parties and any other persons on the Lands on safety related matters, to the extent required to fulfill its responsibilities pursuant to this DBA and the WSHA, regardless of whether or not any contractual relationship exists between Design Builder and any of these entities and whether or not such entities have been specifically identified in this DBA.

D.7.4.1.4 Design Builder shall ensure compliance with, but not be limited to, the following safety and health requirements during the Works:

(a) safety and health orientation of all Design Builder Parties, visitors, and any other persons entering the Lands, in connection with the Project, regardless of whether or not any contractual relationship exists between Design Builder and any of these entities;

(b) provision of personal protection equipment (PPE) for all the personnel carrying out the Works;

(c) provision of special PPE for personnel working on specific tasks that require the use of special equipment and tools;

(d) first aid training for personnel carrying out the Works;

(e) provision of first aid facilities and equipment for personnel carrying out the Works;

(f) hazardous materials handling training for personnel carrying out the Works;

(g) recognition of confined space and its restrictions and safety requirements, and confined space entry training for personnel required to enter confined spaces as part of carrying out the Works;

(h) H_2S Awareness and H_2S Alive® training for hydrogen sulphide as required for personnel carrying out the Works;

(i) fire prevention, detection and response procedures training for personnel;

(j) use of explosives training for any personnel required to handle, store, use or be in the vicinity of explosives, if explosives are required for any specific task on the Works;

(k) forming and maintaining occupational health and safety committees with specific duties and responsibilities;

(l) accident and Serious Incident reporting and investigation in full compliance with the WSHA; and

(m) any other occupational health and safety measures required to ensure health and safety of all persons carrying out the Works, and any other persons occupying or visiting the Lands who come into contact with the Works.

D.7.4.1.5 If Design Builder or any Design Builder Party enters any part of the NEWPCC Site, such Party shall follow the appropriate procedures in Appendix 18P – Coordination Protocol and comply with the safety requirements set out therein.

D.7.4.2 WSHA Orders

D.7.4.2.1 Design Builder shall provide the City with prompt notice of any WSHA Order that Design Builder receives in respect of the Project.

D.7.4.2.2 The City shall, in response to any reasonable request by Design Builder

in relation to a WSHA Order, provide Design Builder with such reasonable assistance as the City is able to offer or arrange.

D.7.4.3 Construction Period Prime Contractor Requirements

D.7.4.3.1 Design Builder shall be the Prime Contractor, as defined in the WSHA and regulations in respect of the Works, at all times from the Effective Date until and including the Final Completion Date. Design Builder shall have all of the responsibilities and duties of the Prime Contractor. Where the City requires access to the areas of the Lands where Design Builder is actively engaged in construction, the City agrees with Design Builder that the City, City Parties and invited visitors will comply with Design Builder's health and safety requirements for the Project, as applicable.

D.7.4.4 Other Employers

D.7.4.4.1 In respect of the Lands if another Employer (the "**Other Employer**") requires access to the Lands to perform work and Design Builder demonstrates, to the satisfaction of the City, acting reasonably, that the Other Employer's work site can be separated by time and space from Design Builder's work site, the City shall require the Other Employer to:

(a) separate the Other Employer's work site by time and space from Design Builder's work site;

(b) acknowledge that, for the purpose of the WSHA, the Other Employer is the Prime Contractor for the Other Employer's work site; and

(c) cooperate with Design Builder (and any other contractors working in the area) and jointly develop and agree on a written workplace health and safety system or process to coordinate Design Builder's and the Other Employer's respective work activities.

D.7.4.4.2 If there are two or more Other Employers involved in work at the Other Employer's work site at the same time then Prime Contractor status shall be clearly assigned to one of the Other Employers in writing by the City.

D.7.4.4.3 Design Builder shall, to the extent required of a Prime Contractor by the WSHA, establish and maintain a health and safety system or process to ensure compliance by its subcontractors with the WSHA.

D.7.5 Design Builder Parties

D.7.5.1 Design Builder shall ensure that any Design Builder Party engaged in the Works is able to comply with all health and safety requirements before commencing their work.

D.7.6 Worksite Hazards

D.7.6.1 Design Builder shall identify worksite hazards and shall develop operational workplace health and safety policies, procedures and plans that are specific to those hazardous aspects of the Works, to ensure the health and safety of every person on the Lands. When requested by the City, Design Builder shall provide copies of these health and safety policies, procedures and plans prior to the commencement of the work.

D.7.6.2 Design Builder shall provide signage at all entrances to the Works which includes, but is not limited to, the following:

(a) all known hazards on site;

(b) all required PPE; and

(c) all emergency response contact persons.

D.7.6.3 Design Builder shall facilitate site tours by the fire department, as required. The City expects that such tours will occur once every three months.

D.7.6.4 If the Workplace Safety and Health Branch of the Manitoba Department of Growth, Enterprise and Trade or any other Governmental Authority conducts a worksite inspection that results in a WSHA Order being issued to Design Builder or any Design Builder Party, Design Builder shall immediately provide written notification and supply copies of such WSHA Order to the City.

D.7.6.5 Notwithstanding Section D.7.6.4, the City may order the suspension of work in cases of recognized imminent danger or when Design Builder fails to comply with a WSHA Order or any other orders issued by any Governmental Authority, or fails to rectify previously identified worksite hazards.

D.7.7 Accident Reporting and Investigations

D.7.7.1 Design Builder shall comply with all requirements of the WSHA and specifically those relating to *Serious Incidents in the Workplace*.

D.7.7.2 Design Builder shall immediately notify the City Representative of any accident, near miss or Serious Incident:

(a) occurring within the Lands involving its own or any Design Builder Parties' vehicles or equipment; and

(b) occurring during the period from the Effective Date to the Final Completion Date which involves a death, serious personal injury, or if there is a third-party property damage in excess of $5,000 or as specified in the WSHA.

D.7.7.3 In the event of a death involving employees of Design Builder or any Design Builder Party during the Project Term, Design Builder shall verbally notify the City Representative within 2 hours of the time when Design Builder first learned of the

death, and follow-up with a written notice and summary of circumstances within 24 hours.

D.7.8 Monthly Health and Safety Reporting

D.7.8.1 Design Builder shall maintain or ensure that full records are kept of all incidents relating to health and safety during the Project Term. These records shall be available for inspection by the City upon reasonable notice, and Design Builder shall present a report of them to the City as and when requested.

D.7.8.2 Design Builder shall prepare and submit, with the Monthly Project Reports, a section or separate report covering health and safety. The monthly health and safety report or section shall describe the performance of Design Builder compared with the requirements of the WSHA and this DBA and standards and procedures set out in Design Builder's Management Systems and Plans.

D.7.8.3 The monthly health and safety report or section shall include, as a minimum:

(a) summary of statistics of Serious Incidents, accidents, and near misses (Include those involving third parties as well as any external documentation such as police reports);

(b) summary of type and quantity of safety meetings and safety review sessions;

(c) comparison of performance against targets;

(d) results of any required auditing;

(e) measures implemented and proposed to be implemented to improve Design Builder's health and safety performance;

(f) health and safety training completed;

(g) the results of the annual review of Design Builder's Health, Safety, and Security Management Plan;

(h) any changes to COR status of Design Builder, or any Design Builder Party or Subcontractor which is required to have COR; and

(i) any correspondence with and governmental agency or regulatory body relating to the safety of the Works.

D.7.9 Safety Meetings

D.7.9.1 From the Effective Date to the Final Completion Date, Design Builder shall conduct health and safety meetings prior to the commencement of each major work phase of the Works, or monthly, whichever occurs more frequently. These meetings are intended as a review of all aspects of health and safety related to that phase of work. Design Builder shall invite the City to send a representative to

attend such safety meetings and shall give reasonable advance notice of such meetings. Meeting minutes for each meeting shall be provided to the City.

D.7.9.2 From the Effective Date to the Final Completion Date, Design Builder shall also conduct daily safety review sessions prior to the commencement of work for the day to outline the potential work hazards associated with the work for that day. Design Builder shall allow representatives from the City to attend such safety review sessions.

D.8 Maintaining Continuity of Plant Operation

D.8.1 Responsibilities

D.8.1.1 Design Builder shall not interrupt functions except as specified herein and in accordance with Appendix 18P – Coordination Protocol. Design Builder shall coordinate the work to avoid any interference with normal operation of plant staff, equipment and processes.

D.8.1.2 The existing wastewater treatment plant continuously receives wastewater and is required to comply with the requirements of *Environment Act Licence No. 2684 RRR*. The existing plant is to remain fully functional and in service and meeting the requirements of *Environment Act Licence No. 2684 RRR* until completion of the Work. Design Builder shall provide continued plant operation during occasions when Design Builder is addressing deficiencies and defects in the design or construction (as applicable).

D.8.1.3 Design Builder shall:

(a) provide shutdown and tie-in details to the City in accordance Section C.3.7, of this Schedule;

(b) schedule short-term and extended shutdowns in advance and show all planned shutdowns in the Project Schedule. Design Builder shall allow an appropriate "window" for each shutdown when assembling the Detailed Project Schedule to indicate to the City the approximate range of dates over which the shutdown may occur. Actual shutdowns and shutdown duration and times shall be fully coordinated with the City. Plant staff will operate the facilities involved in the short-term and extended shutdowns and diversions, unless otherwise noted. Denial of a shutdown request for a specific date shall not entitle Design Builder to modify the Scheduled Substantial Completion Date;

(c) ensure that entire plant shutdowns do not occur unless as specified in Section D.8.3;

(d) ensure that safe access is maintained for all operation and maintenance requirements of the existing plant at all times, housekeeping is maintained at the highest possible level to minimize interference, the security requirements are fulfilled, and the Existing Infrastructure are maintained in weather-tight conditions;

(e) complete all tie-ins to Existing Infrastructure in the shortest practical time frame to minimize interferences, and where appropriate, during periods of low flow and low risk. Scheduling shall reflect that priority;

(f) plan, schedule, and coordinate all work in operating plant areas to minimize interferences while maintaining access for the City and City Parties;

(g) maintain utility services to operate Existing Infrastructure. Design Builder may provide temporary alternative utility connections having submitted the design for review by the City with a Design Submittal and obtained a "Received" endorsement. Design Builder shall remove alternative utility connections when service is not required at end of construction;

(h) provide all necessary temporary pumps, blinds, piping, electrical wiring, controls, labour, and supervision during and subsequent to all activities as required. Temporary pumps and upstream water levels shall be continuously monitored by Design Builder to make all provisions necessary to prevent process upsets, flooding, and bypassing during any diversion pumping operations;

(i) maintain access into, around and out of the Lands for City, City Party, and third-party vehicles. Such vehicles include, liquid sludge hauling trucks, Hauled Liquid Waste trucks, landfill leachate trucks, biosolids trucks, grit and screenings trucks, chemical delivery trucks, maintenance trucks, rail cars, provincial sampling vehicles, and emergency vehicles. Such rights of use of the Existing Infrastructure shall constitute Identified Encumbrances;

(j) provide the services of emergency repair crews on call 24-hours per day, in the event that Design Builder's actions or inaction cause, or result in, damage or compromise of function to Existing Infrastructure or facilities performing daily operations; and

(k) maintain or provide alternate access for public access to the hauled liquid waste receiving facility and Administration Building. Such rights of access shall constitute Identified Encumbrances.

D.8.1.4 Any temporary work, facilities, roads, walks, protection of existing structures, piping, blind flanges, valves, equipment, protection of existing open channels and basins and other items that may be required within Design Builder's work limits to maintain continuous and dependable existing plant operation as a result of potential or actual construction, testing or commissioning activities shall be provided, installed, and maintained by Design Builder at no extra cost to the City.

D.8.1.5 If Design Builder impairs the performance or operation of the existing plant as a result of not complying with specified provisions for continuing plant operations, then Design Builder shall immediately make all repairs or replacements and do all work necessary to restore the plant to operation to the satisfaction of the City. Unless otherwise acceptable to the City, such work shall progress continuously

to completion on an emergency basis 24 hours per day, 7 days per week, at no cost to the City.

D.8.1.6 Payment Adjustment

D.8.1.6.1 Except as otherwise authorized by the DBA, if Design Builder causes a reduction in process performance in the Existing Infrastructure which results in final effluent not meeting *Environment Act Licence No. 2684 RRR*, reduces available capacity within a unit process, or causes the City to call out or assign additional plant staff to mitigate the results of the actions of Design Builder, then Design Builder shall be assessed a Payment Adjustment in accordance with Schedule 14 – Payment Adjustments.

D.8.1.7 Design Builder acknowledges and accepts that the City may shut down the plant or portions thereof as part of normal or emergency operations and the City shall not be held responsible for any impacts on the performance of the Works.

D.8.2 Sewer Surcharging, Spilling and Bypassing

D.8.2.1 Design Builder shall pay all penalties, insurance costs, and costs including legal fees and other expenses imposed on the City, caused by or resulting from the actions or inactions of Design Builder, as a result of:

(a) any sewer surcharging that results in flooded basements at properties outside the Lands;

(b) any bypassing of sewage to surface waters or drainage courses, including to the outfall;

(c) any spillage of sewage that occurs during tie-ins, testing and commissioning; and

(d) any damage to the Existing Infrastructure that results in sewage and/or chemical spillages.

D.8.2.2 Design Builder shall report to the City, in writing, the occurrence of any of the events listed in Section D.8.2.1, within 4 hours of the start of the event.

D.8.2.3 Payment Adjustment

D.8.2.3.1 If Design Builder spills, bypasses, or discharges raw sewage, screened sewage, degritted sewage, or screened and degritted sewage to surface waters or drainage courses, including the outfall, Design Builder shall be assessed a Payment Adjustment in accordance with Schedule 14 – Payment Adjustments. For clarity, this Payment Adjustment will be assessed over and above any fine or penalty assessed to the City for which Design Builder will be responsible.

D.8.3 Plant Shutdown

D.8.3.1 The Existing Infrastructure has some built-in redundancy and Design Builder shall use redundant systems wherever possible to avoid plant shutdowns.

D.8.3.2 The NEWPCC is an operating facility, therefore the plant staff regularly shut down various tanks, processes, equipment, piping, etc. for routine inspection, cleaning and maintenance. Design Builder shall be responsible for coordinating with the plant staff so that Design Builder is aware of upcoming shutdowns and takes account of such shutdowns within its scheduled work activities.

D.8.3.3 The plant can be shut down for short periods under low-flow conditions to facilitate tie-ins to major flow streams, such as:

(a) raw sewage; and

(b) grit effluent.

D.8.3.4 Design Builder shall prepare a Tie-Ins Plan in accordance with Section C.3.7 for each tie-in with the Existing Infrastructure.

D.8.3.5 The frequency and duration of shutdowns cannot be guaranteed. General guidelines to assist Design Builder for long-term planning purposes are as follows:

(a) maximum of 4 hours;

(b) during low diurnal flow periods, typically 4 am to 8 am; and

(c) during the low flow season, typically defined as November to February.

D.8.3.6 Design Builder acknowledges that these constraints are for guidance only and can vary depending on a number of factors including weather, site conditions, and staffing requirements. Design Builder shall plan for deviations from the shutdown constraints listed in this Section D.8.

D.8.3.7 After normal work hours (nights, holidays, etc.), all work premiums, overtime and other costs related to scheduling of process interruptions shall be borne by Design Builder, except for those costs associated with City and City Parties labour.

D.8.3.8 All system shutdowns, complete or partial, temporary or extended, must be acceptable to the City, acting reasonably. Each Design Builder request for shutdown shall be submitted in accordance with the procedure outlined in Schedule 18 Appendix 18P – Coordination Protocol. If in the judgment of the City, a requested shutdown is not required for Design Builder to perform the Work, Design Builder shall utilize alternative methods to accomplish the Work, acceptable to the City, acting reasonably.

D.8.3.9 All shutdowns shall be planned, coordinated with and scheduled at times acceptable to the City, acting reasonably. The scheduling and duration of tie-ins

and connections that require process interruptions or removal of equipment from service, or are dependent on process operations, performance requirements, flow of wastewater, or weather as related to flow rate, shall be coordinated with and acceptable to the City, acting reasonably, based on field conditions and consideration of the above listed factors.

D.8.3.10 Short term shutdowns in plant systems will be allowed for tie-ins to Existing Infrastructure, installation of temporary bulkheads, temporary works, shoring, and similar construction activities.

D.8.3.11 Design Builder shall provide appropriate diversion facilities in accordance with the Tie-in or Shutdown Work Plan that has been endorsed as "Received", in accordance with Schedule 5 – Review Procedure, and at no additional cost to the City, when the plant services cannot be shut down for a sufficiently long time to accomplish the required work. The schedule and duration of short-term shutdowns shall be at the discretion of the City.

D.8.3.12 The City Representative or City Party authorized by the City Representative shall have the right to order Work stopped or prohibit Work that would, in his opinion, unreasonably result in interrupting the necessary functions of the plant operations.

D.8.4 Shutdown Requests

D.8.4.1 If Design Builder determines that a shutdown is required, Design Builder shall follow the shutdown request process in Appendix 18P – Coordination Protocol. The general steps in the shutdown request process are as follows:

(a) Design Builder shall create a draft Tie-in or Shutdown Work Plan;

(b) Design Builder shall issue, to the City, a "Request for Tie-In or Shutdown Meeting Form" complete with the draft Tie-in or Shutdown Work Plan;

(c) the City will review the draft Tie-in or Shutdown Work Plan;

(d) Design Builder shall host the shutdown or tie-in meeting and take note of City comments on the draft Tie-in or Shutdown Work Plan;

(e) Design Builder shall revise the Tie-in or Shutdown Work Plan and submit to the City in accordance with Schedule 5 – Review Procedure; and

(f) Design Builder shall submit a NEWPCC Facility Work Request once the Tie-in or Shutdown Work Plan has achieved a status of "Received", in accordance with Schedule 5 – Review Procedure.

D.8.5 Existing Infrastructure and Operations

D.8.5.1 Access

D.8.5.1.1 City Parties shall have safe access to all areas that remain in operation throughout the construction, testing and commissioning periods. Design

Builder shall locate stored material, dispose of construction debris and trash, provide temporary walkways and fall protection, provide temporary lighting, and other such work as to maintain plant staff access to areas in operation. Access and adequate parking areas for plant staff must be maintained throughout construction.

D.8.5.1.2 Modular chain link fencing or equivalent barrier shall be maintained around the periphery of all excavations, trenches and other hazardous areas to preclude inadvertent access by Design Builder Parties, plant staff or the public.

D.8.5.1.3 Design Builder shall maintain access to 1430 Gibbs Street such that the tenants of the premises may peaceably and quietly enjoy the leased premises.

D.8.5.2 Power, Light, and Communications Systems

D.8.5.2.1 Electric power, lighting service and communications systems shall be maintained in uninterrupted operation in all areas.

D.8.5.2.2 Individual units may be disconnected as required for replacement, but service shall be available at all times including periods when certain plant utilities are out of service.

D.8.5.2.3 Design Builder shall coordinate shutdowns required in order to minimize the total number of shutdowns necessary to complete construction. The City's telephone and internet service to the plant shall be maintained in continuous operation during construction.

D.8.5.2.4 Design Builder shall provide temporary power as required.

D.8.5.2.5 Design Builder shall provide uninterruptable power supplies for critical equipment as required.

D.8.5.2.6 Design Builder has the option of using a standby generator to provide temporary power, subject to acceptance by the City and unless otherwise specified in the contract documents. Any temporary generator shall be insulated to keep noise to a minimum, and within the noise limits specified in Section C.3.2.

D.8.5.3 Drainage and Cleaning of Existing Process Facilities

D.8.5.3.1 When draining existing operating channels, basins, tanks, etc., Design Builder shall direct the fluid back into the wastewater treatment stream so that treatment occurs before discharge to the Red River.

D.8.5.3.2 Following the dewatering of existing operating channels, basins, tanks, etc., varying depths of debris, settled solids and grit, and residual liquids may be encountered. Such materials shall be removed by Design Builder and properly disposed of off-site to provide clear, clean and safe working areas for Design Builder's Work. Design Builder shall sanitize areas as required.

D.8.5.3.3 Solids and grit removal activities shall be conducted in such a manner so as to not leave large accumulations of removed solids, water, etc. on the roadways, walkways and operating surfaces surrounding the tankage. All such surface areas shall be thoroughly flushed and cleaned of all debris, sludge and grit residue at the end of each working day.

D.8.5.3.4 Removal of settled solids, grit, or other debris from stop log grooves may be required prior to insertion of stop logs. Design Builder shall remove such materials, as required, and properly dispose of off-site.

D.8.5.4 Building Heating and Ventilating

D.8.5.4.1 Building heating and ventilating for the existing plant structures and galleries shall be maintained for the entire construction, testing and commissioning periods. Design Builder shall provide ventilation rates equal to or exceeding current ventilation rates.

D.8.5.4.2 Additional temporary heating and ventilation shall be provided as required to maintain adequate heating and/or ventilation of facilities where Design Builder's work is being performed.

D.8.5.4.3 Temperatures in any areas continuously occupied by plant staff shall be regulated between 20 and 25 degrees Celsius, where cooling systems already exist. In continuously occupied areas where cooling systems do not exist, Design Builder shall maintain a minimum temperature of 20 degrees Celsius. Facilities that are not classified by the City as continuously occupied spaces shall have the minimum temperature maintained at 10 degrees Celsius. Areas where potable or other water piping exists shall be maintained at a minimum of 10 degrees Celsius.

D.8.5.5 Controls System

D.8.5.5.1 Existing controls shall be maintained at all times during construction until the new control system is commissioned.

D.8.5.5.2 Existing controls shall only be shut down when connecting existing equipment to the new control system. Design Builder shall submit a Tie-in or Shutdown Work Plan in accordance with Appendix 18P – Coordination Protocol for such connections and such plan must receive an endorsement of “Received”, in accordance with Schedule 5 – Review Procedure, by the City before construction.

D.8.5.5.3 Shutdown of the control system shall be fully planned and coordinated, in accordance with Section D.8.3, with the City and shall be limited to not more than 2 hours.

D.8.5.6 City Water System

D.8.5.6.1 Potable water service shall be maintained in continuous service at all times during construction except for short-term interruptions required for tie-ins.

D.8.5.6.2 Shutdown of the potable water system shall be fully planned and coordinated, in accordance with Section D.8.3 and Appendix 18P – Coordination Protocol ,with the City and shall be limited to not more than two 2 hours.

D.8.5.6.3 Existing fire hydrants within the plant site shall be maintained operational at all times. If Design Builder deems it necessary to remove a fire hydrant from service, Design Builder shall submit a Tie-in or Shutdown Work Plan in accordance with Appendix 18P – Coordination Protocol for such connections and such Tie-in or Shutdown Work Plan must achieve an endorsement of “Received”, in accordance with Schedule 5 – Review Procedure, by the City before construction.

D.8.5.6.4 Design Builder shall provide a fire watch if a fire hydrant is temporarily removed from service. The fire watch shall provide equivalent fire protection as the connected hydrant(s).

D.8.5.7 Flushing Water System

D.8.5.7.1 The existing flushing water services shall be maintained in continuous operation during construction except for short term tie-ins of new or temporary facilities to Existing Infrastructure.

D.8.5.7.2 Design Builder shall provide all temporary supports, relocation of existing piping, or decommissioning of existing flushing water piping including replacement with temporary or permanent flushing water piping as required at no additional cost to the City.

D.8.5.7.3 Shutdowns of the flushing water system shall be fully planned and coordinated, in accordance with Section D.8.3 and Appendix 18P – Coordination Protocol, with the City and shall be limited to not more than 2 hours.

D.8.5.7.4 Design Builder shall submit a Tie-in or Shutdown Work Plan in accordance with Appendix 18P – Coordination Protocol for such connections and such Tie-in or Shutdown Work Plan must achieve an endorsement of “Received”, in accordance with Schedule 5 – Review Procedure, by the City before construction.

D.8.5.8 Well Water

D.8.5.8.1 Design Builder shall maintain wells and well water systems in continuous operation during construction until Existing Infrastructure and equipment using well water have disconnected or connected to an alternate water supply.

D.8.5.8.2 Design Builder shall provide all temporary supports, relocation of existing piping, or decommissioning of existing well water piping including replacement with temporary well water piping as required at no additional cost to the City.

D.8.5.8.3 Shutdown of the well water system shall be fully planned and coordinated, in accordance with Section D.8.3 with the City and shall be limited to not more than 2 hours.

D.8.5.8.4 Design Builder shall submit a Tie-in or Shutdown Work Plan in accordance with Appendix 18P – Coordination Protocol for such connections and such Tie-in or Shutdown Work Plan must achieve an endorsement of “Received”, in accordance with Schedule 5 – Review Procedure, by the City before construction.

D.8.5.9 Seal Water

D.8.5.9.1 A supply of seal water and the necessary connections to existing equipment shall be maintained during construction. Interim piping shall be provided as required.

D.8.5.9.2 Shutdown of the seal water system shall be fully planned and coordinated, in accordance with Section D.8.3 and Appendix 18P - Coordination with the City and shall be limited to not more than 2 hours.

D.8.5.9.3 Design Builder shall submit a Tie-in or Shutdown Work Plan in accordance with Appendix 18P – Coordination Protocol for such connections and such Tie-in or Shutdown Work Plan must achieve an endorsement of “Received”, in accordance with Schedule 5 – Review Procedure, by the City before construction.

D.8.5.10 Networked Systems

D.8.5.10.1 When a networked system is to be modified, Design Builder shall submit a Tie-in or Shutdown Work Plan in accordance with Appendix 18P – Coordination Protocol for such connections and such Tie-in or Shutdown Work Plan must achieve an endorsement of “Received”, in accordance with Schedule 5 – Review Procedure, by the City before construction.

D.8.5.10.2 Shutdown of a networked system shall be fully planned and coordinated, in accordance with Section D.8.3 and Appendix 18P – Coordination Protocol with the City and shall be limited to not more than 2 hours.

D.8.5.10.3 Upon completion of modifications to a networked system, Design Builder must demonstrate that the networked system works for all components, including those previously connected to the network and those most recently added.

D.8.5.10.4 Once components have been connected to a networked system, interruptions to data flow will not be permitted.

D.8.5.11 Payment Adjustment

D.8.5.11.1 Except as otherwise authorized by the DBA, if Design Builder causes a partial or total shutdown of raw sewage flow, process control, traffic, sludge truck hauling, access to 1430 Gibbs Street, natural gas, hydronic loops, heating, ventilation, cooling, electricity, communications, flushing water, potable water, well water, sanitary sewer, land drainage sewer, or any other return flow Design Builder shall be assessed a Payment Adjustment in accordance with Schedule 14 – Payment Adjustments.

D.8.6 Protection of Existing Infrastructure and Operations

D.8.6.1 Design Builder shall plan all work and develop all sequences of construction such that the structural and functional integrity of all Existing Infrastructure, Works and structures surrounding the work areas are maintained and protected from damage that may impede or interrupt plant operations. Design Builder shall also consider the effect and risk associated with not undertaking reasonable precautions or inaction. This shall include:

(a) protection of Existing Infrastructure from damage due to site excavation, site dewatering, drilling of foundations and excavation shoring, driving of foundation piling, etc.;

(b) protection of Existing Infrastructure from damage due to impact by heavy construction or delivery equipment, tools, lifted or conveyed loads, etc.;

(c) protection of Existing Infrastructure from damage due to impact from hoisting mishaps or accidents, crane failure, crane collapse, etc.; and

(d) protection of the interior surfaces and/or liquid contents of Existing Infrastructure from damages or contamination that are detrimental to their intended wastewater treatment process or function due to hoisting mishaps or accidents; spillages or leakage from construction equipment or fuel tanks; construction debris; etc.

D.8.6.2 As used in this Section D.8.6.2, "damage" shall include:

(a) any new cracking, leakage, settlement, tilting position or alignment shifting, obvious areas of impact damage, etc. to the surfaces of each existing structure observed throughout construction;

(b) any sudden or unexplained changes in normal operating water levels or volume capacities of tanks, channels, etc. surrounding the construction

area due to observed cracking, leakages, settlement, etc. of portions of the existing structure, or perceived to be due to similar cracking, leakages, settlements, etc. affecting portions of the existing structure not visible or exposed; and

(c) the potential for damage to existing structures due to failures (or the observed instability or potential for future failure) of Design Builder's excavations, shoring, site dewatering systems, etc. which, if uncorrected could lead to, or contribute to, physical damage to the plant's Existing Infrastructure.

D.8.6.3 All such damages shall be reported to the City, in writing, within 24 hours of Design Builder observation. Design Builder shall include the following in the notification to the City:

(a) date and time of incident;

(b) date and time of observation;

(c) location of damage;

(d) description of the events that caused, or resulted in, damage;

(e) description of the extent of damage;

(f) photographic evidence of damage; and

(g) temporary actions taken to mitigate further damage.

D.8.6.4 All such damages shall immediately be investigated by Design Builder upon observation, and a written report prepared by Design Builder and submitted to the City within 30 Calendar Days following their observation. Reports shall be prepared and sealed by a Professional Engineer. Reports shall include:

(a) full assessment of the locations, nature and extent of the damage;

(b) temporary corrective action and repairs to be made, and Design Builder's proposed schedule;

(c) permanent corrective action and repairs to be made, and Design Builder's proposed schedule;

(d) the effect of such temporary and permanent repairs on Design Builder's Project Schedule and his ability to meet all Milestones. Include a Design Builder’s Schedule Remediation Plan as necessary to demonstrate that such corrective repairs shall be planned and made using means and methods that will not cause delay to the Project Schedule or Design Builder's failure to achieve the Milestones as specified; and

(e) all damages to Existing Infrastructure and structures surrounding the work areas.

D.8.6.5 Damages shall be promptly repaired, to the satisfaction of the City, at Design Builder's expense.

D.8.7 Temporary Flow Isolation

D.8.7.1 If installation of temporary bulkheads and/or portable cofferdams is required for completion of the Work, any temporary device, structure, stoplog, gate, bulkhead or other work required to isolate channels, tanks, conduits, or pipes, shall be designed, fabricated, installed, monitored, maintained and removed by Design Builder. These items shall be placed at the location selected by Design Builder as per the “Received” Tie-in or Shutdown Work Plan, in accordance with Appendix 18P – Coordination Protocol, City owned stoplogs can be used for temporary flow isolation, at Design Builder’s risk, and the City is not responsible for availability of the stoplogs, nor for the performance or suitability of the stoplogs.

D.8.7.2 Where temporary devices, structures, stoplogs, gates or bulkheads are placed into active channels, the maximum open area possible shall be provided to maintain flow with minimum disruption of plant hydraulics and without flooding of tanks, conduits, or other plant facilities. The sizing, design and water-tightness of all such temporary devices, structures, stoplogs, gates or bulkheads shall be determined by Design Builder.

(a) Design Builder shall submit design drawings (and calculations when requested by the City) 21 Calendar Days before scheduled fabrication of cofferdams and/or bulkheads. Submittal shall include description of proposed installation methods, special labour requirements such as underwater divers, localized removal of settled solids and anticipated sequences of bulkhead installation and bulkhead removal.

(b) The design submittal shall achieve an endorsement of “Received”, in accordance with Schedule 5 – Review Procedure before Design Builder's submittal of the shutdown request and Tie-in or Shutdown Work Plan for which the bulkhead is to be used.

(c) Design Builder shall be responsible for field measurements, fabrication, installation, maintenance and removal of the temporary bulkheads and/or portable cofferdams.

(d) Temporary flow isolation work may also require localized removal of varying depths of settled solids to clear the channel or basin area in the immediate area where the work is required.

(e) Existing stop log grooves, valves, gates, etc. may be used by Design Builder for temporary flow isolation at Design Builder's risk. The City does not warrant or guarantee that the grooves, valves, gates, etc. are acceptable for temporary flow isolation.

D.9 Site Restoration

D.9.1 General

D.9.1.1 Design Builder shall be responsible for restoring all landscaped areas and Existing Infrastructure that are affected by construction activities to a condition equal to or better than the existing condition.

D.9.1.2 If Design Builder uses the Staging Area Lands, it shall be restored as follows:

(a) removal of any temporary works including site offices, utilities and sanitary sewers installed by Design Builder;

(b) removal of all debris, stockpiled materials, construction rubbish; and

(c) removal of all paving or gravel, including any existing paving or gravel. Finish grade the Staging Area Lands to ensure adequate land drainage to existing land drainage sewers. Apply topsoil and seed in accordance with Appendix 18B – Specifications.

D.9.2 Control Point Surveys

D.9.2.1 Design Builder shall:

(a) replace any of the existing survey monuments on the Lands that have been damaged or removed by Design Builder during the performance of the Works. Design Builder shall locate replacement survey monuments in accessible areas;

(b) replace any existing legal survey markers on the Lands that have been damaged or removed by Design Builder during the performance of the Works. Design Builder shall use permanently affixed brass pin survey markers in accordance with Good Industry Practice;

(c) within 3 months after Substantial Completion, before Final Completion, cause a professional land surveyor, registered in the Province of Manitoba, to conduct a location survey of the Infrastructure on the Construction Lands. Survey accuracy shall be in accordance with Section G.2.2; and

(d) deliver a copy of the survey data with an accompanying AutoCAD drawing file, numbered in accordance with Appendix 18D – City Standards, and reports to the City including the following:

(i) horizontal coordinates shall use the UTM coordinate system, referenced to the City of Winnipeg June 90 (LBIS) system; and

(ii) vertical coordinates shall use the NAD83 reference system.

D.9.2.1.1 Refer to Section G.2.2.2 for coordinate benchmark locations.

D.10 Operations and Maintenance Responsibilities

D.10.1 General

D.10.1.1 Further to the DBA, Design Builder shall be responsible for operating and maintaining the Works until such time as the Infrastructure is turned over to the City to operate and maintain the Works subsequent to Design Builder achieving Substantial Completion.

D.10.2 Operations

D.10.2.1 Where a requirement is indicated for Design Builder to operate and maintain the Infrastructure or a portion of the Infrastructure for testing or commissioning, this shall include:

(a) monitoring;

(b) electrical switching;

(c) mechanical systems control; and

(d) all other operational and maintenance requirements associated with the Works or the specific portion of the Works.

D.10.2.2 For clarity, Design Builder's responsibilities are limited to the operation of the Works at the NEWPCC and do not extend to operation of the Existing Infrastructure. Design Builder's operation requirements are not intended to include any requirements associated with the *Water and Wastewater Infrastructure Operators Regulation* (77/2003).

D.10.2.3 Design Builder shall not be permitted to operate an individual process, system or the Infrastructure except for commissioning and testing purposes. The City will only accept operations of the plant in totality at the time of Substantial Completion. For clarity, the City will not accept operations of an individual process or system before Substantial Completion.

D.10.3 Maintenance of the Works until Final Completion

D.10.3.1 Design Builder shall protect all new facilities and equipment including foundations, empty tanks, pumps, piping, diffusers, etc. from freezing, flooding, heat, sun exposure, rainfall, ice pellets, hail, wind and other weather hazards.

D.10.3.2 Equipment that has been installed shall be maintained by Design Builder per the manufacturer's recommendations. For example, installed pumps shall be turned according to manufacturer's recommendation.

D.10.3.3 Design Builder shall, upon achieving commissioning and testing certificates for a process area, drain and clean all components of the area including:

(a) emptying all tankage and cleaning said tankage; and

(b) flushing all pumps and piping.

D.10.3.4 Notwithstanding Section D.10.3.3, Design Builder will be exempt from draining, cleaning and flushing if Substantial Completion is achieved within 30 Calendar Days of completing testing and commissioning, provided no adverse impact on the Infrastructure has occurred as a result of testing and commissioning activities.

D.10.3.5 Design Builder will be permitted to operate utilities and HVAC mechanical to maintain buildings and equipment, in accordance with Section D.5.3.1(b). Design Builder shall bear the cost of maintaining the facilities until achieving Final Completion. Design Builder shall sub-meter natural gas, potable water, and electricity. Design Builder shall leave sub-meters installed for City use after Substantial Completion.

D.10.3.6 Design Builder shall provide a Design Builder's Maintenance Management Plan as set out in Section D.2.8.

SECTION E. TRAINING, COMMISSIONING AND TESTING

E.1 General

E.1.1 Responsibilities

E.1.1.1 Design Builder is responsible for the supply of all management, professional and technical services, supervision services, training, commissioning and testing quality management, labour, materials and equipment for performing all of the duties and obligations necessary for delivering all of the requirements in this Section E.

E.1.1.2 Design Builder is responsible for obtaining and/or complying with requirements of all Permits, Licences and Approvals required for the Work.

E.1.1.3 Design Builder shall perform all testing and commissioning activities to demonstrate to the City that the design and construction meet the Technical Requirements. All testing and commissioning shall be performed in accordance with the Commissioning Plan endorsed "Received" in accordance with Schedule 5 – Review Procedure.

E.1.1.4 Design Builder shall be responsible for providing all necessary personnel, equipment, chemicals, and water (potable or otherwise) for testing and commissioning activities. Design Builder shall submit documentation that demonstrates successful completion of testing and commissioning.

E.1.2 Training

E.1.2.1 Design Builder shall be responsible for training the plant staff, in accordance with the requirement of Appendix 18G – Training Requirements and Appendix 18B – Specifications.

E.1.2.2 Notwithstanding the requirements of Appendix 18G – Training Requirements, Design Builder shall provide additional training sessions to the plant staff on the following equipment:

(a) raw sewage pumps;

(b) screens, screen conveyors and washer/compactors;

(c) grit removal tanks, grit washers, and grit dewatering equipment; and

(d) standby generators.

E.1.2.2.1 The supplemental training sessions shall be held after Substantial Completion but before Final Completion. Training shall be in accordance with Appendix 18G – Training Requirements and Appendix 18B – Specifications.

E.1.2.2.2 Ensure appropriate plant staff are trained in complete overhaul of the raw sewage pumps, by the pump manufacturer, in addition to any other training required.

E.1.2.3 Equipment Training

E.1.2.3.1 Design Builder shall be knowledgeable on the proper installation, testing, operation and maintenance of all equipment and systems Design Builder provides for or installs in the Works and any communication and control systems. Design Builder shall provide sufficient training and education opportunities to City Parties in accordance with Appendix 18G – Training Requirements to enable the City to properly operate and maintain such equipment and systems.

E.1.3 Commissioning

E.1.3.1 Objectives

E.1.3.1.1 The objectives of commissioning are to:

(a) commission all equipment, piping systems components, systems and sub-systems at the Infrastructure before being put into continuous service for their intended purpose;

(b) demonstrate that the Infrastructure meets all the requirements of Applicable Law, and the DBA;

(c) demonstrate that systems are ready for turnover to the City at Substantial Completion;

(d) develop a baseline of data and test results to allow Design Builder and the City to optimize and monitor the future performance; and

(e) provide evidence and documentation to verify that Design Builder has met the objectives set out in Section E.1.3.1.

E.1.3.2 Commissioning Lead

E.1.3.2.1 Design Builder shall designate an individual as a commissioning lead ("**Commissioning Lead**") who shall be responsible for coordinating activities during commissioning, and performing other commissioning activities, including the following:

(a) providing reviews and comments during the design phase to identify potential commissioning challenges as a result of a particular design;

(b) organizing and leading commissioning meetings;

(c) updating, expanding, and refining test procedures, tracking tools, and documentation for all Commissioning Phases;

(d) developing schedules for all commissioning activities, integrating the Commissioning Phases and related activities into the Project Schedule, and coordinating all required commissioning activities;

(e) noting and documenting any inconsistencies or deficiencies in the operation of systems, sub-systems and equipment, ensuring system compliance and recommending approaches or modifications to enhance system performance;

(f) documenting results of all commissioning activities and assembling reports; and

(g) submitting all documentation as specified in this Section E.1.3.

E.1.3.3 Commissioning Notifications

E.1.3.3.1 Design Builder shall give the City at least 45 Business Days' notice in advance of performing any commissioning activities, or such other notice period set out in this Section E.1.3.

E.2 Commissioning Management Plans

E.2.1 General

E.2.1.1 The commissioning management plans described in this Section E.2 shall form part of Schedule 4 – Design Builder's Management Systems and Plans. Updated and revised plans shall supersede previous versions.

E.2.1.2 The commissioning management plans, including any updated and revised plans, shall be reviewed in accordance with Schedule 5 – Review Procedure.

E.2.1.3 Design Builder shall revise and update the commissioning management plans as required to reflect any changes to the management of the commissioning of the Infrastructure. Design Builder shall, at a minimum, provide the City with an annual update to the construction management plans.

E.2.2 Commissioning Plan

E.2.2.1 Design Builder shall develop a plan for commissioning the Works (the "**Commissioning Plan**") that sets out a detailed plan and sequence of activities and requirements for commissioning all equipment, components, systems and sub-systems including at a minimum:

(a) a list of systems, sub-systems and equipment that Design Builder will use to conduct the commissioning;

(b) procedures, tests and documentation to demonstrate that Design Builder has complied with the requirements of this Section E.1.3, written in an appropriate level of detail such that an independent party would be able to repeat the procedures and tests to verify results;

(c) a detailed plan describing all data sources, on-line measurement devices, sampling locations, methods of calculation, procedures, tests and documentation that will be used and provided to the City to demonstrate that Design Builder has met the performance requirements for equipment, systems and sub-systems as set out in the DBA;

(d) any surrogate tests Design Builder proposes to use during Performance Testing in place of tests for which the results would not be available within 2 Business Days of sample collection owing to the time required to perform the test, in which case Design Builder shall be responsible for establishing a statistically significant relationship between the test results at 95 percent level of confidence limits (upper and lower confidence limits) using a two-tailed t-test;

(e) procedures that will be followed by all Professionals of Record and qualified professionals to verify that the Infrastructure meets the requirements of the Technical Requirements and the Final Design;

(f) procedures and requirements for verification of installation by all equipment manufacturers;

(g) the names and organization of the commissioning team member firms and individuals, including their responsibilities, authority and decision-making protocols;

(h) all coordination activities that Design Builder will need to perform during commissioning;

(i) procedures for minimizing disruptions to daily plant operations;

(j) procedures to ensure compliance with the Licence including:

(i) communication protocols with the City, including during non-business hours;

(ii) names of Design Builder personnel that will be responsible for Licence compliance and their contact information; and

(iii) the commissioning schedule setting out the timelines for all activities, including:

(A) the schedule and sequence for commissioning each system, sub-system and equipment;

(B) target dates for commissioning completion of product receiving or hauling facilities and any other facility that requires coordination with a third party;

(C) target dates for completion of each of the Commissioning Phases; and

(D) the delivery of Submittals with appropriate allowances for review in accordance with Schedule 5 – Review Procedure;

(k) ensuring that the commissioning schedule is integrated with the Project Schedule;

(l) procedures for documenting all test results;

(m) templates of standard forms to be used throughout the Commissioning Phases;

(n) procedures for reviewing all test results including certification by the Quality Manager;

(o) the Water Management Plan, in accordance with Section E.2.3; and

(p) any additional commissioning activities set out in the Technical Requirements or the Final Design.

E.2.2.2 If Design Builder elects to modify the Commissioning Plan between the submission of the final Commissioning Plan and the commencement of Equipment Checkout, Design Builder shall submit such updated Commissioning Plan and achieve an endorsement of “Received”, in accordance with Schedule 5 – Review Procedure, to the City 60 Calendar Days before the commencement of Equipment Checkout.

E.2.2.3 Payment Adjustment

E.2.2.3.1 If Design Builder elects to modify the Commissioning Plan between the submission of the final Commissioning Plan and the commencement of Equipment Checkout, but Design Builder fails to submit such updated Commissioning Plan and achieve an endorsement of "Received", in accordance with Schedule 5 – Review Procedure, to the City 60 Calendar Days before the commencement of Equipment Checkout, a Payment Adjustment shall be assessed in accordance with Schedule 14 – Payment Adjustments.

E.2.3 Water Management Plan

E.2.3.1 Design Builder shall submit a plan that explains, in detail, how clean water will be routed through the Infrastructure to perform Functional Testing and how process fluids will be diverted and routed through the upgraded plant to perform Systems Operational Testing (the "**Water Management Plan**").

E.2.3.2 The Water Management Plan shall be a standalone document and, at minimum, describe the following:

(a) clean water sources and quality;

(b) process fluid sources and quality;

(c) if process fluid quality adequately simulates design conditions and adjustments or treatments that will be made to ensure process fluid quality adequately simulates design conditions;

(d) temporary facilities and equipment required to transfer the clean water and process fluids;

(e) drawings showing the location of temporary facilities and equipment;

(f) level of redundancy to ensure Functional Testing and Systems Operational Testing are not interrupted;

(g) how impact to plant staff will be minimized;

(h) disposal locations for the clean water and process fluids;

(i) decommissioning plan for the temporary facilities and equipment; and

(j) safety procedures for the temporary facilities and equipment.

E.2.3.3 If Design Builder elects to use City potable water, Design Builder shall sub-meter and reimburse the City for use of such water.

E.3 Commissioning Activities

E.3.1 Commissioning Phases

E.3.1.1 The commissioning phases for the Project ("**Commissioning Phases**") are as follows:

(a) Equipment Checkout;

(b) Functional Testing;

(c) Systems Operational Testing; and

(d) Performance Testing.

E.3.1.2 During the Equipment Checkout, Functional Testing and Systems Operational Testing phases, Design Builder shall perform commissioning on a system-by-system basis generally organized by the process functions (and may further divide any system into its sub-systems for commissioning purposes).

E.3.1.3 During Performance Testing, commissioning shall occur on an Infrastructure-wide basis.

E.3.2 Sampling and Analysis

E.3.2.1 During commissioning and up to completion of Performance Testing, Design Builder shall:

(a) perform all sampling and analysis in accordance with the Sampling and Analytical Plan as set out in Schedule 18 Appendix 18L - Sampling and Analytical Plan;

(b) collect all samples of sufficient size to allow the City to perform duplicate testing and deliver such samples to the City on the date of sampling;

(c) use a third party laboratory accredited by the Canadian Association for Laboratory Accreditation for the testing of all samples;

(d) submit analytical test results to the City within 7 Calendar Days of sample collection (or at a different frequency agreed to by the City, acting reasonably); and

(e) repeat commissioning activities as required to comply with the requirements of this Section E.1.3.1.

E.3.3 Equipment Checkout

E.3.3.1 At a minimum, Design Builder shall perform the following activities as part of Equipment Checkout:

(a) all Equipment Checkout activities set out in the Technical Requirements,

the Final Design and the Commissioning Plan;

(b) field quality assurance and quality control activities; and

(c) verification by the Professional of Record or qualified professional to certify that all equipment and workmanship complies with the Technical Requirements, the Final Design and the Commissioning Plan, including performing:

(i) site visits;

(ii) visual inspections;

(iii) review of construction quality assurance and quality control reports, commissioning reports, Monthly Project Report and all installation and testing reports; and

(iv) preparation of marked-up drawings and other documents noting any inconsistencies, conflicts or changes to the Technical Requirements or the Final Design.

E.3.3.2 Equipment Checkout Completion

E.3.3.2.1 "**Equipment Checkout Completion**" shall occur in respect of any equipment, components, systems and sub-systems when Design Builder demonstrates the following for each applicable piece of all equipment, components, systems and sub-systems:

(a) completed the activities set out in Section E.3.3.1 and confirmed that all results comply with the Technical Requirements, the Final Design and the Commissioning Plan;

(b) corrected any Deficiencies identified during the Equipment Checkout; and

(c) document all results of Equipment Checkout activities in accordance with the Technical Requirements, the Final Design and the Commissioning Plan, and delivered all such results to the City in accordance with Schedule 13 – Document Management System;

(i) consolidated electronic copy of all completed test forms, including equipment checkout forms;

(ii) documentation that demonstrates the equipment has been delivered, stored and maintained in accordance with the manufacturer's requirements;

(iii) manufacturer's written certification that the equipment is installed correctly in accordance with its recommendations;

(iv) Deficiency log identifying Deficiencies and corrective actions taken by Design Builder; and

(v) certification from the Engineer of Record or qualified professional that Design Builder performed Equipment Checkout in accordance with the Technical Requirements, the Final Design and the Commissioning Plan.

E.3.4 Functional Testing

E.3.4.1 Design Builder shall not commence Functional Testing for any systems and sub-systems until such system or sub-system has achieved Equipment Checkout Completion.

E.3.4.2 Design Builder shall perform the Functional Testing using:

(a) load banks to simulate electrical loads on the power distribution system and power generation system at design capacity;

(b) natural gas for the testing of all boilers;

(c) diesel for the testing of all standby diesel generator units; and

(d) clean water obtained from the City's potable water system, flushing water from the plant, or well water, as appropriate, for testing all other systems and sub-systems.

E.3.4.3 Design Builder may, at its convenience, install temporary facilities to allow water to flow in a run-around loop through the Infrastructure from the outlet of a unit process to upstream processes. Design Builder shall remove any such temporary facilities before Substantial Completion and show such facilities in its design. At a minimum, Design Builder shall perform the following activities as part of Functional Testing:

(a) all Functional Testing activities set out in the Technical Requirements, the Final Design and the Commissioning Plan;

(b) field quality assurance and quality control activities;

(c) design verification by the Professional of Record or applicable qualified professionals to certify that all construction was completed in accordance with the Technical Requirements, the Final Design and the Commissioning Plan, including performing:

(i) site visits;

(ii) visual inspections;

(iii) review of construction quality assurance and quality control reports, commissioning reports, Monthly Project Report and all installation and testing reports; and

(iv) preparation and review of marked-up drawings and other documents noting any inconsistencies, conflicts or changes to the Technical Requirements and the Final Design.

E.3.4.4 Design Builder shall:

(a) confirm the hydraulic capacity of all equipment within the system or sub-system and introduction of clean water, flushing water, or well water into the Infrastructure to test hydraulic capacity in accordance with the Water Management Plan, the Technical Requirements and the Final Design;

(b) verify by field testing that the flow splitting hydraulic elements meet the requirements as set out in the Technical Requirements and the Final Design;

(c) operate the system or sub-system in all modes and scenarios of operation set out in the Technical Requirements, the Final Design and the Commissioning Plan and demonstrate that it can function for its intended purpose and design capacity;

(d) confirm that all data acquisition, process control algorithms, equipment interlocks, alarms, events and notifications, process and gas monitoring and other data acquisition features are fully functional;

(e) demonstrate in the field to the City Representative, or any City Party designated by the City Representative, that the SOPs are accurate and comprehensive by performing each procedure in accordance with the instructions set out therein;

(f) operate the system or sub-system automatically under PCS control without manual intervention and continuously over 72 consecutive hours through normal operating conditions set out in the Technical Requirements, the Final Design and the Commissioning Plan (or if the Technical Requirements and Final Design set out a requirement for a system or sub-system to operate intermittently or otherwise normally operate for a period less than 24 consecutive hours in a day, the applicable requirement in the Technical Requirements, and Final Design shall apply); and

(g) perform a comprehensive data review by the Professional of Record or qualified professional to confirm the system or sub-system performance meets the requirements set out in the Technical Requirements and the Final Design.

E.3.4.5 Functional Testing Completion

E.3.4.5.1 "**Functional Testing Completion**" shall occur in respect of a system or sub-system when Design Builder demonstrates all the following:

(a) all arc-flash labels have been installed, if applicable;

(b) Design Builder has, in respect of the applicable system or sub-system:

(i) completed the activities set out in Section E.3.4 and confirmed the results comply with the Technical Requirements, the Final Design and the Commissioning Plan;

(ii) corrected all Deficiencies identified during Functional Testing;

(iii) performed operations and maintenance activities in accordance with the manufacturer's requirements and in accordance with the Technical Requirements and Final Design; and

(iv) documented all results of Functional Testing activities in accordance with the Technical Requirements, the Final Design and the Commissioning Plan, and delivered all such results to the City for review in accordance with Schedule 13 – Document Management System including:

(A) consolidated electronic copy of all completed test forms, including Functional Testing Completion forms using the standard forms provided by Design Builder and previously accepted by the City. Submit forms in a categorized and logical order;

(B) manufacturer's written certification that the equipment functions as intended by the manufacturer and was tested in accordance with its recommendations;

(C) deficiency log identifying Deficiencies and corrective actions taken by Design Builder;

(D) certification from the Engineer of Record or qualified professional that the construction was completed in accordance with the Final Design; and

(E) certification that Functional Testing was conducted in accordance with the Technical Requirements, the Final Design and the Commissioning Plan.

E.3.5 Systems Operational Testing

E.3.5.1 Design Builder shall not commence Systems Operational Testing for any system and sub-systems until such system or sub-system has achieved Functional Testing Completion.

E.3.5.2 Design Builder shall perform Systems Operational Testing using:

(a) clean water for testing the water distribution system; and

(b) influent to the system or sub-system diverted by Design Builder from the appropriate upstream system for testing all other systems and sub-systems.

E.3.5.3 Design Builder shall make reasonable efforts to ensure that the composition of process fluids during Systems Operational Testing of a system or sub-system is representative of the influent conditions expected to be received by that system or sub-system as set out in the Technical Requirements and the Final Design.

E.3.5.4 Design Builder may at its convenience install temporary facilities to allow liquid to flow in a run-around loop through the Infrastructure. Design Builder shall remove any such temporary facilities before Substantial Completion and show such facilities in its design.

E.3.5.5 Design Builder shall not be permitted to discharge any fluids to the outfall.

E.3.5.6 At a minimum, Design Builder shall perform the following activities as part of Systems Operational Testing:

(a) all Systems Operational Testing activities set out in the Technical Requirements, the Final Design and the Commissioning Plan;

(b) field quality assurance and quality control activities;

(c) operate the system or sub-system in all modes and scenarios of operation set out in the Technical Requirements, the Final Design and the Commissioning Plan and demonstrate that it can function for its intended purpose;

(d) increase the flows directed to the system or sub-system in a controlled manner to prevent process upsets within the Infrastructure;

(e) ensure that all process fluids during Systems Operational Testing are representative of conditions that will be encountered during operation of the Infrastructure as set out in the Technical Requirements and the Final Design;

(f) refine and calibrate all electrical, instrumentation and control systems and sub-systems to optimize its performance during operation in its intended service condition;

(g) confirm that all data acquisition, process control algorithms, equipment interlocks, alarms, events and notifications, process and gas monitoring and other data acquisition and supervisory control features are fully operational;

(h) operate the system or sub-system automatically and continuously under PCS control without major alarms or shutdowns, without manual intervention (except that reasonable manual intervention will be allowed if

required by the Technical Requirements, Final Design or to simulate service conditions to carry out testing) and continuously over 7 consecutive days at operating conditions representative of service conditions set out in the Technical Requirements and the Final Design;

(i) if applicable to the system or sub-system, demonstrate in the field to the City Representative, or any City Party designated by the City Representative, that the SOPs for the following are accurate and comprehensive by performing each procedure set out in the SOPs in accordance with the instructions set out therein:

(i) filling and removal of consumables from vessels (including activated carbon, chemicals and fuel);

(ii) field instrumentation calibration;

(iii) PCS control calibration or optimization; and

(iv) additional SOPs as requested by the City;

(j) demonstrate in the field to the City Representative, or any City Party designated by the City Representative, that any Standard Operating Procedures selected by the City Representative, acting reasonably, are accurate and comprehensive;

(k) updating by the Professional of Record or qualified professional of all applicable Design Submittals to reflect data collected during commissioning; and

(l) data review and certification by the Professional of Record or qualified professional that the performance of the system or sub-system meets the requirements set out in the Technical Requirements and the Final Design.

E.3.5.7 Systems Operational Testing Procedures

E.3.5.7.1 Design Builder shall undertake the Systems Operational Testing in accordance with the requirements of this Section E.3.5.7.

E.3.5.7.2 Design Builder shall provide a daily report to the City Representative that includes:

(a) available results of Systems Operational Testing activities;

(b) completed daily operational checks forms;

(c) list of any applicable alarms that occurred at the Infrastructure with the time of occurrence and resolution;

(d) troubleshooting log that describes upsets or unusual events and the action taken by Design Builder to resolve upsets and unusual events;

(e) all required data measured and recorded during the Systems Operational Testing, including all certified laboratory analyses, chemical consumption, instrument calibrations, pressures and other measurements, with copies of original data sheets, log sheets, calculations, laboratory reports and test sheets;

(f) applicable PCS process reports including alarms and trends; and

(g) all certifications relating to testing, evaluation, analyses and performance.

E.3.5.7.3 Design Builder shall terminate the 7-day test if at any time during the 7 consecutive days of testing a system or sub-system:

(a) the system or sub-system fails to comply with the Technical Requirements, the Final Design or the Commissioning Plan;

(b) the PCS indicates any of the following types of alarms:

(i) possibility of injury or loss of human life or catastrophic environmental incident;

(ii) possibility of major Infrastructure or equipment damage or significant environmental incident;

(iii) possibility of a serious process upset that would cause applicable Treatment Standards to be violated; and

(iv) event that occurred outside regular working hours and required plant staff response.

E.3.5.7.4 Design Builder shall operate any temporary equipment to maintain the operation of the system or sub-system, except as may be reasonably required to carry-out the test and simulate service conditions.

E.3.5.7.5 Design Builder shall perform any maintenance, repair or replacement in order to maintain the operation of the system or sub-system.

E.3.5.7.6 When Design Builder has remedied the applicable deficiency set out in Section E.3.5.7.3, Design Builder shall re-start the 7-day test at day 1.

E.3.5.7.7 If Design Builder, in conducting the Systems Operational Testing, does not successfully achieve Systems Operational Testing Completion for a system or sub-system, Design Builder shall take all action necessary (including making all capital investments, improvements or modifications, repairs and replacements and changes to operating and maintenance practices) in order to achieve Systems Operational Testing Completion and shall re-test the system or sub-system in accordance with this Section E.3.5.

E.3.5.7.8 Design Builder may, subject to demonstrating that the actions taken will

not invalidate or materially change the test results for the whole system or sub-system, as reasonably acceptable to the City, re-test the system or sub-system for compliance only with the Systems Operational Testing Completion requirements not previously achieved through the performance of earlier Systems Operational Testing.

E.3.5.7.9 Design Builder shall provide the City Representative with at least 2 Business Days' written notice of any re-performance of a 7-day test.

E.3.5.8 Systems Operational Testing Completion

E.3.5.9 "**Systems Operational Testing Completion**" shall occur in respect of a system or sub-system when Design Builder demonstrates all of the following:

(a) all residuals meet the requirements of Section C.4.1.5.2;

(b) the systems or sub-systems complies with the Odour Standard and noise requirements as specified in Section C.4.1.5.2;

(c) Design Builder has, in respect of the applicable system or sub-system:

(i) performed all applicable operations and maintenance activities;

(ii) corrected all deficiencies identified during Systems Operational Testing; and

(iii) completed the activities set out in Section E.3.5 and confirmed that all results comply with the Technical Requirements, the Final Design and the Commissioning Plan;

(d) demonstrated compliance with procedures set out in Section E.3.5.7;

(e) documented all results of Systems Operational Testing activities in accordance with the Technical Requirements, the Final Design and the Commissioning Plan, and delivered all such results to the City including the following minimum Documents:

(i) a consolidated electronic copy of all completed test forms, including Functional and Systems Operational Testing forms using the standard forms provided by Design Builder and previously accepted by the City. Submit forms in a categorized and logical manner;

(ii) monitoring reports for all applicable parameters set out in the Commissioning Plan;

(iii) applicable daily PCS process monitoring reports;

(iv) chronological record of operational adjustments made and description of the resulting effects on operations, including the time period to return to normal operations;

(v) list of alarms that occurred with the time of occurrence and resolution;

(vi) record of operator interventions;

(vii) equipment or system start-up and shut down information;

(viii) troubleshooting log that describes upsets or unusual events and the actions taken to resolve such upsets and events;

(ix) manufacturer's written certification that the system or sub-system is performing as intended by the manufacturer and was tested in accordance with its recommendations;

(x) deficiency log itemizing corrective actions taken by Design Builder;

(xi) updated SOPs and SWPs based on observations during the Systems Operational Testing period;

(xii) certification from Professional of Record or qualified professional that performance of the system or sub-system complies with the Technical Requirements and Final Design; and

(xiii) certification from the Commissioning Lead and the Independent Quality Certifier that testing was conducted in accordance with the Commissioning Plan.

E.3.5.10 Application for Certificate of Systems Operational Testing Completion

E.3.5.10.1 If Design Builder believes it has achieved the requirements for Systems Operational Testing Completion of a system or sub-system, Design Builder may apply to the City Representative for a Certificate of Systems Operational Testing Completion for that system or sub-system.

E.3.5.10.2 No later than 15 Business Days after receipt of Design Builder's application for a Certificate of Systems Operational Testing Completion for a system or sub-system, the City Representative will review the basis for Design Builder's application for Systems Operational Testing Completion and then within a further 5 Business Days:

(a) issue a certificate indicating that Systems Operational Testing Completion has been achieved (a "**Certificate of Systems Operational Testing Completion**"); or

(b) reject Design Builder's application for a Certificate of Systems Operational Testing Completion and provide Design Builder with a list of reasons for such rejection.

E.3.5.10.3 If the City Representative determines that Design Builder has not achieved the requirements for Systems Operational Testing Completion

for a system or sub-system, Design Builder shall correct any Deficiencies identified by the City under Section E.3.5.10.2 above, and retest, before submitting a further application for a Certificate of Systems Operational Testing Completion.

E.3.5.10.4 The process set out in this Section E.3.5.10 shall continue to apply until the City Representative issues a Certificate of Systems Operational Testing Completion for the applicable system or sub-system.

E.3.6 Performance Testing

E.3.6.1 "**Performance Testing**" means testing of the Infrastructure to demonstrate that the Infrastructure

(a) is capable of operating under PCS control 24 hours per day for 30 consecutive days based on the Standard Staffing Levels;

(b) meets all Treatment Standards prior to conveying flow to the existing primary influent conveyance system; and

(c) complies with the Technical Requirements and the Final Design.

E.3.6.2 Design Builder shall give the City at least 30 days' notice in advance of performing any Performance Testing.

E.3.6.3 Performance Testing Activities

E.3.6.3.1 Design Builder shall not commence Performance Testing until all systems and sub-systems in the Infrastructure has achieved a Certificate of Systems Operational Testing Completion.

E.3.6.3.2 At a minimum, Design Builder shall perform the following activities as part of the Performance Testing:

(a) receive all sewage delivered to the Infrastructure from the main interceptor, the northwest interceptor and the northeast interceptor and pump to the headworks;

(b) receive all internal recirculated flows such as grit washings and treated centrate effluent,

(c) treat all influent through the Infrastructure;

(d) operate the Infrastructure and process all wastewater through the Infrastructure for a continuous 30-day period under operating conditions consistent with those set out in the Technical Requirements, the Final Design and the Commissioning Plan;

(e) regularly monitor the systems and sub-systems for the parameters set out in the Commissioning Plan;

(f) perform other Performance Testing activities set out in the Technical Requirements, the Final Design and the Commissioning Plan; and

(g) perform all operations and maintenance activities for the Infrastructure.

E.3.6.3.3 For clarity, the City operations personnel will also be monitoring the performance of the Infrastructure during the 30-day test and may report any alarms to Design Builder at any time.

E.3.6.3.4 Notwithstanding Section E.3.6.3.3, Design Builder is responsible for adequate equipment performance, addressing all alarms and ensuring compliance with all Permits, Licenses and Approvals.

E.3.6.4 Performance Testing Procedures

E.3.6.4.1 Design Builder shall undertake the Performance Testing in accordance with the requirements of this Section E.3.6.4 and the following:

(a) Design Builder shall be primarily responsible for monitoring of the Infrastructure and shall perform operations and maintenance activities as set out in the Commissioning Plan;

(b) Design Builder shall provide a daily report to the City Representative that includes:

(i) applicable daily PCS process reports including alarms and trends;

(ii) troubleshooting log that describes upsets or unusual events and the action taken by Design Builder to resolve upsets or unusual events;

(iii) all required data measured and recorded during the Performance Testing, including all certified laboratory analyses, chemical consumption, instrument calibrations, pressures and other measurements, with copies of original data sheets, log sheets, calculations, laboratory reports and test sheets; and

(iv) all necessary certifications relating to testing, evaluation, analyses and performance.

E.3.6.4.2 Design Builder shall terminate the Performance Testing if at any time during Performance Testing:

(a) the Infrastructure fails in any way to comply with the Treatment Standards;

(b) Design Builder operates any temporary equipment to maintain the

operation of the Infrastructure; or

(c) Design Builder performs any maintenance, repair or replacement in order to maintain the operation of the Infrastructure.

E.3.6.4.3 When Design Builder has remedied the applicable deficiency set out above, Design Builder shall re-start the Performance Testing at day 1.

E.3.6.4.4 If Design Builder, in conducting the Performance Testing, does not successfully achieve Performance Testing Completion, Design Builder shall take all action necessary (including making all capital investments, improvements or modifications, repairs and replacements and operating and management practices changes) to achieve Performance Testing Completion and shall re-test the Infrastructure in accordance with this Section E.3.6.4.

E.3.6.4.5 Design Builder may, subject to the reasonable approval of the City, re-test the Infrastructure for compliance only with the Performance Testing Completion requirements not previously achieved through the performance of earlier Performance Testing.

E.3.6.4.6 Design Builder shall provide the City with at least 3 Business Days' written notice of any re-test of the Performance Testing.

E.3.6.5 Performance Testing Completion

E.3.6.5.1 "**Performance Testing Completion**" shall occur when Design Builder demonstrates all of the following:

(a) the Infrastructure operates automatically under PCS control 24 hours per day for 30 consecutive days without major alarms or shutdowns;

(b) all systems have achieved and continue to meet the requirements for Systems Operational Testing Completion during the Performance Testing;

(c) the Infrastructure treats all wastewater received from the three interceptor sewers;

(d) all equipment is available for service, including redundant equipment;

(e) the Infrastructure meets all Treatment Standards; and

(f) Design Builder has:

(i) completed the activities set out in Section E.3.6.3 and demonstrated compliance with procedures set out in Section E.3.5.7;

(ii) documented all results of Performance Testing activities in accordance with the Technical Requirements, the Final Design and the Commissioning Plan, and delivered such results to the City in accordance with Schedule 13 – Document Management System and the Independent Certifier, including the following minimum Submittals:

(A) a consolidated electronic copy of all completed test forms, including Performance Testing forms using the standard forms provided by Design Builder and acceptable to the City;

(B) monitoring reports for all systems and sub-systems for all applicable parameters set out in the Commissioning Plan;

(C) PCS process monitoring reports;

(D) chronological record of operational adjustments made and description of the resulting effects on operations, including the time period to return to normal operations;

(E) list of alarms that occurred, including the time of occurrence and resolution;

(F) troubleshooting log that describes upsets or unusual events and the action taken by Design Builder to resolve such upsets or events;

(G) certification from Engineer of Record or qualified professional that performance of the Infrastructure complies with the Technical Requirements and Final Design;

(H) certification from the Commissioning Lead and the Professional of Record and qualified professional that testing was conducted in accordance with the Commissioning Plan; and

(iii) achieved an endorsement of “Received”, in accordance with Schedule 5 - Review Procedure, for the Decommissioning Plan (second submission).

E.3.6.6 Certificate of Performance Testing Completion

E.3.6.6.1 If Design Builder believes it has achieved the requirements for Performance Testing Completion, Design Builder may apply to the City Representative for a Certificate of Performance Testing Completion. As soon as reasonably practical, and in any event not later than 15 Business Days’ after application by Design Builder for a Certificate of Performance

Testing Completion, the City Representative, review the basis for Design Builder's application for Performance Testing Completion and:

(a) issue a certificate indicating that Performance Testing Completion has been achieved (a "**Certificate of Performance Testing Completion**"); or

(b) reject Design Builder's application for Performance Testing Completion and provide Design Builder with a list of reasons for such rejection.

E.3.6.6.2 If the City Representative determines that Design Builder has not achieved the requirements for Performance Testing Completion, Design Builder shall correct any deficiencies identified by the City Representative under Section E.3.6.5.1 above and re-perform the Performance.

SECTION F. SUBSTANTIAL COMPLETION

F.1 Substantial Completion Requirements

F.1.1 Substantial Completion Conditions

F.1.1.1 Further to Section F1 of the DBA, to achieve Substantial Completion, all of the following must be achieved in relation to the Works:

(a) all components of the Works have been designed, permitted, constructed, tested and commissioned, and are substantially complete in accordance with the Final Design and the Technical Requirements;

(b) all relevant components of the Works have been decommissioned in accordance with Design Builder's Design and Applicable Law;

(c) Design Builder has remediated all affected Lands and removed all temporary works, including City site offices and Design Builder's construction site offices, (except for temporary offices that Design Builder shall maintain for completing Deficiencies at the Lands and for performing Operations Advisory Services in accordance with Section G.3), access roads and all laydown and staging areas;

(d) all components of the Works are ready for their intended use and are functioning as designed, subject only to minor deficiencies that, either individually or in the aggregate, do not adversely impact the operation of the Works or the operations and maintenance of the Infrastructure;

(e) Design Builder has achieved the Certificate of Performance Testing Completion;

(f) achieved endorsement of "Received", in accordance with Schedule 5 - Review Procedure, for the:

(i) Permitting Management Plan (second submission); and

(ii) Project Close-out Plan;

(g) the City has received an updated NEWPCC Fire Safety Plan with support from the Design Builder;

(h) Design Builder has been issued a Certificate of Substantial Performance by the City, pursuant to the *Builders' Lien Act* (Manitoba);

(i) Design Builder has obtained a Certificate of Compliance in accordance with Section D.4.10 as required;

(j) all applicable Permits, Licences and Approvals required under Applicable Law that are necessary for the continued routine operation of the Works have been duly obtained and are in full force and effect including:

(i) final occupancy permit; and

(ii) all written authorizations or other approvals from governmental authorities required for operating the Works 24 hours per day under PCS control based on Standard Staffing levels, and Design Builder has obtained a "Received" comment on the updated Permitting Management Plan submitted pursuant to Section C.2.3;

(k) Design Builder has submitted the Post-Construction Condition Assessment Report;

(l) Design Builder has submitted the HIRA Workshop report;

(m) Design Builder has submitted a preliminary As-Built Submittal to the City for review in accordance with Schedule 18 – Technical Requirements Appendix 18N – Design Submittal Requirements and shall at a minimum:

(i) include preliminary as-built information as set out in Section G.2 up to Substantial Completion (As-Built Construction Drawings and Record Drawings do not require seal from Professional of Record);

(ii) include Phase 1 O&M Information;

(iii) include Phase 1 Asset Registry;

(iv) has achieved at least an endorsement of "Observations" in accordance with Schedule 5 – Review Procedure.; and

(v) be submitted in the following format:

(A) A native digital copy of all three-dimensional models developed for the design and construction;

(B) 1 set of A1 bound hard copies; and

(C) Text searchable PDF design drawings files organized by area and then by discipline;

(n) Design Builder has delivered training in accordance with Section E.1.2 and Schedule 18 – Technical Requirements Appendix 18G – Training Requirements and has submitted complete Training Records;

(o) Design Builder has carried out all validation tests and submitted all required testing reports, validated models, and other documentation in accordance with Appendix 18K – Special Studies and Models including:

(i) fire protection study;

(ii) validation test sampling methods and procedures for air dispersion modeling;

(iii) power study model; and

(iv) lighting design model;

(p) Design Builder has completed final cleaning of the Lands in accordance with Appendix 18B – Specifications;

(q) Design Builder has submitted all IFC Submittals and all Post IFC Submittals to the City for review in accordance with Schedule 5 – Review Procedure and achieved a “Received” comment on each Submittal;

(r) Design Builder shall provide a declaration by the Engineer of Record that the Works have been performed in accordance with the Technical Requirements, Design Builder’s Designs and Design Builder’s Management Systems and Plans, including, the Quality Management System;

(s) Design Builder shall ensure that any changes from applicable Submittals have been reviewed by the Professionals of Record and the Independent Reviewer and do not adversely affect the integrity, durability, reliability, safety or quality of the Infrastructure, or result in any contravention of any requirement of this DBA;

(t) closure by the City of all the following items including written confirmation by the Engineer of Record and Quality Manager that all resultant changes, revisions, and updates have been incorporated in the completed Work:

(i) CRSs;

(ii) NCRs and NCR Plans;

(iii) RFIs; and

(iv) RFSs; and

(u) Design Builder shall provide a declaration by the Engineer of Record that all Change Orders, Disputes and Relief Events have been identified for the Works occurring prior to the Substantial Completion and no further Change Orders, Disputes, or Relief Events will be claimed for the Works occurring prior to Substantial Completion.

SECTION G. CLOSE-OUT

G.1 Close out Requirements

G.1.1 Project Close-Out Plan

G.1.1.1 Design Builder shall submit a plan for project close-out (the "**Project Close-Out Plan**") for review in accordance with Schedule 5 – Review Procedure at least 180 Calendar Days before the expected Substantial Completion Date. The Project Close-Out Plan shall include:

(a) a schedule of activities from Substantial Completion to acceptance of the Infrastructure indicating major milestones, including:

(i) Final Completion;

(ii) Warranty Period;

(iii) Operations Advisory Period;

(iv) Process Performance Guarantee; and

(v) acceptance;

(b) a list of the required project close-out documentation including a schedule for submission;

(c) a plan for the Operations Advisory Period including:

(i) the name and qualifications of the Operations Advisory Lead and staff supporting the Operations Advisory Lead;

(ii) methods and documentation for advising the plant staff;

(iii) methods of communication between Operations Advisory Lead and support staff, especially for critical or emergency situations; and

(iv) identification of response time for supporting staff to physically report to the NEWPCC facility during critical or emergency situations; and

(d) a plan for the Process Performance Guarantee, including:

(i) identification of process sampling and testing protocol; and

(ii) schedule for sampling and testing.

G.1.2 As-Built Submittal

G.1.2.1 Before the Final Completion Date, Design Builder shall submit the As-Built Submittal to the City as set out in Appendix 18N – Design Submittal Requirements for review in accordance with Schedule 5 – Review Procedure.

G.1.2.2 The As-Built Submittal shall capture all final, record versions of all relevant information from the Project to capture any changes that were made, provide a base of documentations to maintain and operate the infrastructure and capture any rationale that impacted the design during construction. The final version shall capture any design and construction changes, including those made during the course of construction to comprehensively capture the full design of the Infrastructure.

G.1.3 Requirements for Project Close-out Documents

G.1.3.1 Project close-out documents include all as-built information, all documents required for the As-Built-Submittal, and all other documents described in this Section G to achieve a Certificate of Acceptance.

G.1.3.2 The Professional of Record, Quality Manager and Independent Quality Certifier shall sign and seal all project close-out documents.

G.1.3.3 The following criteria shall be satisfied when Design Builder submits the Project Closeout Documents:

(a) Design Builder shall utilize the Area Codes and Asset identifiers that align with Appendix 18H – Asset Registry where applicable; and

(b) Design Builder shall number the drawings in accordance with Appendix D – City Standards.

G.2 As-Built Information

G.2.1 As-Built Construction Reports

G.2.1.1 Design Builder shall summarize all Project documentation and information for the Work and incorporate into reports (the **"As-Built Construction Reports"**) such that the City has a permanent record of the Work. For clarity, the expectation is that the As-Built Construction Reports are the sole location for provision of Project documentation and information and include all information included in Design Builder's IFC Submittal.

G.2.1.2 Design Builder shall submit the As-Built Construction Reports as part of the As-Built Submittal in accordance with Appendix 18N – Design Submittal Requirements.

G.2.2 As-Built Construction Drawings and Record Drawings

G.2.2.1 General

G.2.2.1.1 Design Builder shall prepare all As-Built Construction Drawings and Record Drawings, based on the drawings included in the IFC Submittal, and all documents of any kind that record the as-built features of the Infrastructure, to:

(a) be certified and signed by a Professional of Record, confirming and certifying that the As-Built Construction Drawings and Record Drawings truly and accurately represent the as-built conditions, that any changes from the applicable IFC Submittal have been reviewed by the Professional of Record, and as required a qualified professional, and do not adversely affect the integrity, durability, reliability, safety or quality of the Infrastructure, or result in any contravention of any requirement of this DBA;

(b) follow CSA S250-11 for mapping of all underground utility infrastructure required for Record Drawings, except Record Drawings shall be prepared using the information included in Appendix 18C – Drafting Requirements and Appendix 18D – City Standards;

(c) follow ASCE/CI 38-02 for documenting existing utilities in Record Drawings that may be uncovered while carrying out the work;

(d) be clearly marked as an As-Built Construction Drawing or Record Drawing, as the case may be, by use of a stamp or a label in the notes;

(e) indicate that the drawing was originally signed and sealed by the person responsible for the design, naming that person in the declaration;

(f) maintain the original drawing number; and

(g) show record locations, sizes and details of construction as executed.

G.2.2.2 Drawing Reference System

G.2.2.2.1 Design Builder shall meet the following requirements for all As-Built Construction Drawings and Record Drawings:

(a) horizontal coordinates shall use the UTM coordinate system, referenced to the City of Winnipeg June 90 (LBIS) system; and

(b) vertical coordinates shall be referenced to the NAD83 system.

G.2.2.2.2 The bench mark locations for the horizontal and vertical coordinates are included in Table 13.

Table 13: Bench Mark Locations

	City of Winnipeg June 90 (LBIS)		NAD83
	Northing	**Easting**	**Elevation**
BM 1	5534996.006	636000.318	231.073
BM 2	5534816.615	635804.484	230.670
BM 3	5535144.163	635145.506	232.293
BM 4	5535479.063	635036.233	231.014

G.2.2.3 As-Built Information for Decommissioned Facilities

G.2.2.3.1 Design Builder shall provide all as-built information for all facilities that have undergone decommissioning. The as-built information shall include As-Built Construction Drawings and Record Drawings, as appropriate, on:

(a) conduits (abandoned or removed);

(b) pipes (abandoned or removed);

(c) tunnels;

(d) foundations; and

(e) utilities.

G.2.2.4 Accuracy of Record Drawings

G.2.2.4.1 Where Infrastructure will be buried as part of the Final Design, whether existing, reused, repurposed, new or abandoned, Design Builder shall provide Record Drawings describing the location of the buried Infrastructure.

G.2.2.4.2 Acceptable location accuracies for various types of buried Infrastructure are shown in Table 14. Accuracy levels are defined in CSA S250-11.

Table 14: Accuracy Levels Required on Record Drawings of Buried Infrastructure

Buried Infrastructure	Accuracy Level
Piles	Level 1
Pipes	Level 1
Conduits	Level 2
Foundations	Level 2
Tunnels	Level 2
Utilities	Level 1

G.2.3 As-Built Construction Specifications

G.2.3.1 Design Builder shall:

(a) Prepare all As-Built Construction Specifications to:

(i) be certified and signed by a Professional of Record, confirming and certifying that As-Built Construction Specifications truly and accurately represent the as-built conditions, that any changes from the applicable IFC Submittal have been reviewed by the Professional of Record, and as required a qualified professional, and do not adversely affect the integrity, durability, reliability, safety or quality of the Infrastructure, or result in any contravention of any requirement of this DBA;

(ii) where the Technical Specifications list multiple alternative products or models that can meet the Technical Requirements, the As-Built Construction Specifications shall indicate the specific products and models incorporated into the Infrastructure;

(iii) be clearly marked as an As-Built Construction Specifications by use of a stamp or a label in the notes; and

(iv) indicate that the Technical Specifications were originally signed and sealed by the person responsible for the design, naming that person in the declaration.

G.2.4 As-Built Project Schedule

G.2.4.1 Design Builder shall submit a complete As-Built Project Schedule in accordance with Appendix 18N – Design Submittal Requirements. The As-Built Project Schedule shall identify all Project as-built critical paths and shall include the following (the "**As-Built Project Schedule**"):

(a) all activities identified in the Project Schedule, including all added activities and Change Orders;

(b) activity durations shall be the actual number of separate workdays during which work was performed on the activity;

(c) total man-days for an activity shall be the actual number of man-days that were required to complete the activity;

(d) the schedule network shall indicate the actual start date and finish date of each activity; and

(e) Scheduled Substantial Completion Date and Scheduled Final Completion Date and Milestones reflecting the actual date each was completed.

G.3 Operations Advisory

G.3.1 Operations Advisory Period

G.3.1.1 Upon achieving Substantial Completion, Design Builder shall handover operation of the Infrastructure to City's plant staff.

G.3.1.2 Design Builder shall be responsible for providing operations advisory services for a period of 365 Calendar Days after Substantial Completion (the "**Operations Advisory Period**").

G.3.2 Operations Advisory Services

G.3.2.1 Design Builder shall be responsible for providing operations advisory services to assist the City's plant staff as follows (collectively, the "**Operations Advisory Services"**):

(a) on-call services to provide advise over telephone, email or videoconferencing, at the request of the City anytime during the Operations Advisory Period; and

(b) 2 full days of on-site services shall be provided at each of the following intervals:

(i) 2 months into the Operations Advisory Period;

(ii) 6 months into the Operations Advisory Period; and

(iii) the end of the Operations Advisory Period.

(c) during each site visit the Operations Advisory Lead shall review plant performance including:

(i) reviewing set points;

(ii) reviewing plant data, alarms, and PCS data trends;

(iii) discussing operations questions with plant staff;

(iv) observing equipment wear, vibration, and noise; and

(v) and any other items that affect plant performance; and

(d) additional site visits as requested by the City. These site visits will be covered under Cash Allowances in accordance with Section H2 of the DBA.

G.3.2.2 Design Builder may have additional site visit for other reasons, such as fulfilling warranty claims, or adjusting equipment to meet the Process Performance Guarantees. Such site visits shall not be construed as Operations Advisory Services and will not be covered under the Cash Allowances.

G.3.2.3 Payment Adjustment

G.3.2.3.1 Design Builder shall respond to a City request for operational advice within 4 hours of the City issuing the request. Such response at minimum shall acknowledge the receipt of the request and provide an estimated timeframe for providing a solution to the request. Failure by Design Builder to respond to a request from the City within 4 hours and with the minimum required information shall result in a Payment Adjustment in accordance with Schedule 14 – Payment Adjustments.

G.3.3 Operations Advisory Reporting

G.3.3.1 Design Builder shall submit summary reports after each site visit by the Operations Advisory Lead which shall include:

(a) summary of plant performance;

(b) changes to any set points;

(c) recommendations to plant staff;

(d) any observations of abnormal equipment wear, vibration or noise; and

(e) any other items or activities carried out while on site.

G.3.4 Operations Advisory Services Completion

G.3.4.1 "**Operations Advisory Services Completion**" shall occur when Design Builder completes all of the following:

(a) provided Operations Advisory Services for the Operations Advisory Period; and

(b) provided all reports and related documentation as required under Section G.3.3.

G.3.4.2 Certificate of Operations Advisory Services Completion

G.3.4.2.1 If Design Builder believes it has completed the requirements for Operations Advisory Services, Design Builder may apply to the City for a Certificate of Operations Advisory Services Completion. It is Design Builder's responsibility to demonstrate that all requirements have been met and to submit all documents in a neat and organized manner so as to allow expeditious review by the City.

G.3.4.2.2 As soon as reasonably practical, and in any event not later than 10 Business Days' after application by Design Builder, the City will review the basis for Design Builder's application for a Certificate of Operations Advisory Services Completion and:

(a) issue a Certificate indicating that Operations Advisory Services Completion has been achieved (a "**Certificate of Operations Advisory Services Completion**"); or

(b) reject Design Builder's application for Operations Advisory Services Completion and provide Design Builder with a list of reasons for such rejection.

G.3.4.2.3 If the City determines that Design Builder has not achieved the requirements for completion of Operations Advisory Services, Design Builder shall correct any deficiencies identified by the City and re-apply for the certificate. The process set out in this Section G.3.4 shall continue until the City issues a Certificate of Operations Advisory Services Completion.

G.4 Process Performance Guarantees

G.4.1 General Procedure

G.4.1.1 Design Builder has made several Process Performance Guarantees, as set out in Appendix 18R – Process Performance Guarantees, and the City will verify that these Process Performance Guarantees are met, in accordance with Appendix 18R – Process Performance Guarantees.

G.4.1.2 Failure by Design Builder to meet these Process Performance Guarantees will result in the City retaining some, or all, of the Process Performance Guarantee Letter of Credit in accordance with Section C of the DBA. Calculation of the amount retained shall be as per Appendix 18R – Process Performance Guarantees.

G.5 Final Completion

G.5.1 Final Completion Conditions

G.5.1.1 To achieve Final Completion, all of the following must be achieved in relation to the Works:

(a) completion of the Work, including the correction and rectification of all items on the Deficiency List;

(b) delivery of control point surveys;

(c) As-Built Submittal has been endorsed as “Received” in accordance with Schedule 5 – Review Procedure;

(d) Design Builder has carried out validation tests of its ground model and submitted all required testing reports, validated models, and other documentation in accordance with Appendix 18K – Special Studies and Models;

(e) submit 1 set of mylar final As-Built Construction Drawings and Record Drawings after As-Built Submittal has been endorsed as “Received” in accordance with Schedule 5 – Review Procedure;

(f) submit 1 additional set of As-Built Construction Drawings and Record Drawings as required by Appendix 18F – Operation and Maintenance Information;

(g) completion of landscaping;

(h) Demobilization and restoration of the Lands; and

(i) Design Builder shall provide a declaration by the Engineer of Record that the Works have been performed in accordance with the Technical Requirements, Design Builder’s Designs and Design Builder’s Management Systems and Plans, including, the Quality Management System.

G.6 Warranty

G.6.1.1 Refer to the DBA for the standard warranty provisions for the Project.

G.6.1.2 Refer to Schedule 18B – Specifications for extended warranties over and above the Warranty Period.

G.7 Acceptance

G.7.1 Certificate of Acceptance

G.7.1.1 Further to Section F7 of the DBA, all of the following must be achieved in relation to the Works before the City will issue a Certificate of Acceptance:

(a) Design Builder has carried out validation tests of its air dispersion model and submitted all required testing reports, validated models, and other documentation in accordance with Appendix 18K – Special Studies and Models; and

(b) Design Builder has received a Certificate of Operations Advisory Services Completion.