Schedule 18

Appendix 18F - Operation and Maintenance Information

SECTION A DEFINITIONS

A.1 Capitalized Terms

A.1.1 Capitalized terms used in this Appendix 18F have the meanings set out in Schedule 18 – Technical Requirements unless otherwise expressed in this Schedule18F.

A.2 Definitions

A.2.1 **"Area Manuals"** has the meaning set out in Section D.1.1

A.2.2 **"Asset Information"** has the meaning set out in Section C.1.1;

A.2.3 **"Commissioning Records"** has the meaning set out in Section C.3.1;

A.2.4 **"Draft O&M Information"** has the meaning set out in Section B.3.2;

A.2.5 **"Failure Mode and Effects Criticality Analysis" or "FMECA** has the meaning set out in Section C.4.1;

A.2.6 **"Final O&M Information"** has the meaning set out in Section B.3.3;

A.2.7 "**Operation and Maintenance Information**" or "**O&M Information**" has the meaning set out in Section B.1.1.1;

A.2.8 **"Operation and Maintenance Manuals"** has the meaning set out in Section E.1.1;

SECTION B O&M INFORMATION

B.1 Content Overview

B.1.1 Design Builder shall provide a complete set of information (the "**Operation and Maintenance Information**" or "**O&M Information**") in accordance with this Appendix 18F to furnish City staff with all the information required to operate and maintain the Infrastructure. The scope of the O&M Information shall address the complete Infrastructure.

B.1.2 The O&M Information shall fully comply with the requirements of this Appendix 18F and shall include:

(a) Asset Information, in accordance with Section C;

(b) Safety management documents in accordance with Section B;

(c) Area Manuals, in accordance with Section D;

(d) Operation and Maintenance (O&M) Manuals in accordance with Section E;

(e) Drawing Set, in accordance with Section F.

B.1.3 Each document associated with the O&M Information shall be written in a cohesive manner.

B.2 Coordination with the Training Program

B.2.1 The Training Program shall be based upon the O&M Information.

B.2.2 Design Builder shall prepare the associated sections of the O&M Information prior to developing the training courses indicated in Schedule 18 – Technical Requirements – Appendix 18G – Training Requirements.

B.3 Phasing of O&M Information

B.3.1 The O&M Information shall be prepared in 2 phases as follows.

B.3.2 The draft phase of the O&M Information (the "**Draft O&M Information**") shall comprise all O&M Information.

(a) the Draft O&M Information shall be submitted to the City for review in accordance with Schedule 5 – Review Procedure and receive an endorsement of "Received" or "Observations" a minimum of 60 Calendar Days prior to the start of training on the Infrastructure; and

B.3.3 The second phase of the O&M Information (the **Final O&M Information**") shall be provided upon completion of the classroom and field training, comprehensively contain the following:

(a) the Final O&M Information shall contain all requirements identified within this Appendix 18F and updates to the O&M Information produced in the Draft;

(b) As part of the As-Built Submittal, Design Builder shall submit the Final O&M Information for review in accordance with Schedule 5 – Review Procedure and continuously update until a "Received" endorsement is received; and

(c) Design Builder shall provide the following for the final copies, prior to Final Completion:

(i) 1 electronic copy; and

(ii) 2 hard copies of the complete set of each of the Final O&M Information components.

B.4 Asset Identification

B.4.1 Design Builder shall reference all physical structures, processes, plant and equipment in each of the Area Manual and Operations & Maintenance Manuals using identification that is consistent with the data provided in accordance with Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry and the *WWD Identification Standard* in Appendix 18D – City Standards.

B.4.2 Design Builder shall utilize the equipment identifier and asset description in all references to an Asset.

B.5 General O & M Information Requirements

B.5.1 General

B.5.1.1 The Area Manuals and the Operation and Maintenance Manuals are two separate manuals and subsets of the Operation and Maintenance Information detailed in Section D and Section E.

B.5.1.2 The requirements of Section B shall apply to both the Area Manuals and Operations and Maintenance Manuals.

B.6 Language

B.6.1 Design Builder shall prepare all content in plain English.

B.6.2 Design Builder shall write assuming all Works are complete. Do not refer to equipment as “new”, “existing” “old”, or other similar adjectives as they are not applicable from an operations and maintenance perspective.

B.6.3 Design Builder shall prepare descriptive writing, which explains how something works, in the 3rd person, active voice, indicative. For example:

(a) “The tank fills with wastewater after the upstream gate is opened.”

B.6.4 Design Builder shall prepare instructions, which command the reader to do something, in the second person, active voice and imperative. For example:

(a) “After verifying the system pressure, open valve HV-M681A, located next to the pump”.

B.7 Formatting

B.7.1 Design Builder shall utilize double siding as follows:

(a) configure all 8.5” x 11” pages to be double-sided for printing;

(b) configure all 11” x 17” pages to be single sided;

(c) begin each section on the front side of a page (odd-page number); and

(d) ensure electronic files are appropriately configured for double sided printing without manual intervention.

(e) Design Builder shall maintain similar format as existing City documents.

B.7.2 The contents of every manual shall include:

(a) cover and cover spine;

(b) title page;

(c) document revision and approval page;

(d) table of contents (covering the complete manual including all binders and appendices);

(e) table of tables;

(f) table of figures; and

(g) abbreviations.

B.7.3 Design Builder shall begin each major section within each manual on a new page.

B.7.4 Design Builder shall utilize an arial font for all text with a line spacing of “single”, except as noted.

B.8 Danger, Warning and Caution Notices

B.8.1 Design Builder shall provide danger notices throughout each of the Area Manuals and O&M Manuals where there is a hazard that, if not avoided, *will* cause serious personal injury, death, or major property damage.

(a) Design Builder shall reference Safe Work Procedures as appropriate.

(b) Design Builder shall utilize Danger notices similar to those already used by the City.

B.8.2 Design Builder shall provide warning notices throughout each of the Area Manuals and O&M Manuals where there is a hazard that can cause serious personal injury, death, or major property damage.

(a) Design Builder shall use warning notices similar to that already used by the City.

B.8.3 Design Builder shall provide caution notices throughout the each of the Area Manuals and O&M Manuals where there is a hazard that can cause minor or moderate personal injury, or property damage.

(a) Design Builder shall reference Safe Work Procedures as appropriate.

(b) Design Builder shall use notices for hazards that are similar to those already used by the City.

B.9 Conventions

B.9.1 When referring to modes or states as displayed on HMI screens, Design Builder shall utilize italics and capitalize the term. For example: “The pump will only start in Auto mode.”

B.10 Figures and Drawings

B.10.1 Design Builder shall include figures in all volumes of each of the O&M Information to provide the users with a clear understanding of the specific written content. Design Builder shall utilize figures to complement text.

B.10.2 Design Builder shall utilize figures that:

(a) are scaled as appropriate for inclusion in the manuals such that the figure is legible;

(b) have appropriate line-weights for legibility in the manuals;

(c) have appropriate symbol and abbreviations legends, where appropriate;

(d) do not depend on colour for understanding. Where colour is utilized, ensure that a secondary form of identification is utilized, such as hatching or shading, to ensure that colour blindness and grey shade photocopying is accommodated; and

(e) have the text appropriately scaled with the minimum size font displayed as equivalent to a 10pt font.

B.10.2.1 For schematic figures showing gates and valves, Design Builder shall utilize outlined symbols to show gates / valves in the normal open position and filled (solid) symbols to show gates / valves in the normal closed position.

B.10.3 As appropriate, Design Builder shall reference drawings in the Drawing Set with other manuals. However, Design Builder shall not include or attach drawings to manuals other than the Drawing Manual. Design Builder shall utilize figures rather than drawings in volumes other than the Drawing Set.

B.10.4 The use of drawing references within the various manuals shall not replace the requirement to use figures, as specified or appropriate.

B.11 Photographs

B.11.1 Design Builder shall utilize colour photographs to provide the users with a clear understanding of the specific written content and to complement the text.

B.11.2 Design Builder shall utilize JPEG format with appropriate resolution for all photographs.

B.11.3 Design Builder shall ensure all photographs are identified as to the content.

B.11.4 Where referring to a specific item with a photograph, Design Builder shall provide circles, arrows, and other visual cues to identify the specific content being referred to.

B.12 Referencing

B.12.1 Within each manual, Design Builder shall include references to other relevant sections for the convenience of the reader.

B.12.2 Material required within a given manual shall be contained within that manual. Design Builder shall not use any cross-referencing between manuals, except as follows:

(a) manuals may reference drawings in the Drawing Set.

B.13 Hardcopy Requirements

B.13.1 All hardcopy manuals shall be bound in white heavy-duty, 'D-style', three ring binders with transparent cover and spine pockets. Design Builder shall utilize a maximum spine size of 75 mm.

B.13.2 Binder cover spines shall be titled with:

(a) the City of Winnipeg logo;

(b) the facility name ("NEWPCC");

(c) the manual name (e.g. "Area Manual");

(d) the area (e.g. "Area C – Centrate"), if applicable;

(e) the binder number, if separate binders are used for the manual; and

(f) if more than one binder is necessary, the binders should be labelled 1 of X, 2 of X etc. (X being the total number of binders).

B.13.3 Binders shall include heavy-duty durable plastic dividers featuring a numbered index tab to subdivide the chapters with the numbers aligning with the numbering in the table of contents. The dividers shall have stepped sides and rounded corners.

B.13.4 Design Builder shall provide the following page requirements:

(a) letter-sized;

(b) minimum paper weight:

(i) 90 g/m^2 (24lb) paper for Final O&M Information.

B.13.5 Design Builder shall provide a minimum of 10 percent spare capacity for additional material in each binder.

B.14 Electronic File Requirements

B.14.1 Design Builder shall provide all electronic deliverables in:

(a) text-searchable PDF format consistent with City systems; and

(b) native-file format, except for manufacturer documentation.

B.14.2 Design Builder shall provide to the City all native electronic material utilized to develop the O&M Information and all supporting documents, including but not limited to:

(a) O&M Manual electronic files in Microsoft Word (docx) format;

(b) photographs in JPEG format;

(c) presentations in Microsoft PowerPoint (pptx) format;

(d) figures and drawings in native AutoCAD or Microsoft Visio format (VSD); and

(e) supporting Microsoft Excel (xlsx) files.

B.14.3 Electronic source files shall be reasonably divided to aid in the City updating the O&M Information over time. In no case shall a single file be used to address content in more than one manual or area. Electronic source files over 100 pages should not typically be used.

SECTION C ASSET INFORMATION

C.1 General

C.1.1 Design Builder shall provide an organized comprehensive system of all required Asset information to allow City personnel to operate and maintain the Infrastructure (the "**Asset Information**").

C.1.2 The Asset Information shall be comprehensive and include, but not be limited to, all information presented in the O&M Manuals specified in Section E.

C.1.3 Design Builder shall provide the Asset Information in electronic format. Hardcopies are not required except as required by other sections of this Appendix 18F or the Technical Requirements.

C.2 Organization

C.2.1 Design Builder shall organize the Asset Information such that it can be filterable by:

(f) manufacturer and model number);

(g) equipment identifier, where the information is specific to the individual asset

(h) Asset hierarchy, in accordance with Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry;

(i) Asset classification, in accordance with Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry;

(j) Asset specification, in accordance with Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry;

C.2.2 The specific Assets will reference the Asset Information via the Asset index, as described in Section E.11.

C.2.3 For each Asset, Design Builder shall include:

(k) installation date

(l) In service date;

(m) Commissioning Records, as per Section C.3;

(n) Failure Mode and Effects Criticality Analysis, as per Section C.4;

C.3 Commissioning Records

C.3.1 Design Builder shall include all Commissioning Records (the "**Commissioning Records**") associated with a specific Asset. For clarity, commissioning records provided during commissioning may be used, but shall be organized in accordance with this Section C.3.

C.3.2 Commissioning Records associated with an overall process or system that is not clearly identified as a single Asset shall be provided as per Section SECTION B(a).

C.3.3 The Commissioning Records shall include, the following as applicable:

(a) pressure vessel test certificates;

(b) fixed lifting equipment test certificates;

(c) portable lifting equipment test certificates;

(d) fire alarm test certificates;

(e) asset pre-commissioning test forms and reports;

(f) asset performance tests certificates;

(g) structural test results;

(h) fall arrest connection test results;

(i) device configuration parameters and settings;

(j) mechanical equipment commissioning results and reports;

(k) equipment commissioning certificates;

(l) pressure test certificates;

(m) electrical equipment commissioning test results, including final relay set points;

(n) security system acceptance documentation; and

(o) CCTV system acceptance documentation.

(p) Backflow prevention test certificates

(q) Certificates required by authority having jurisdiction (AHJ).

C.4 Failure Mode and Effects Criticality Analysis

C.4.1 Provide an analysis of all the potential modes of failure that could prevent the Asset from operating within its design parameters (the **"Failure Mode and Effects Criticality Analysis" or "FMECA"**) for each Asset in the Infrastructure that meets the following criteria:

(a) Assets with an Asset Criticality Rating of '7' or greater determined in accordance with Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry; and

(b) Assets with a 'significant impact' score for at least one criticality factor in accordance with Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry.

C.4.2 The FMECA shall be carried out sufficiently early in the design process to allow for any 're-design' to be accommodated as a failure management strategy. 'Re-design' may entail for example a one-off change to the built-in capability of a system, including modifications to hardware, software and can also cover changes to procedures.

C.4.3 Design Builder shall base the FMECA on manufacturer documentation and industry good practice.

C.4.4 Design Builder shall submit a copy of records from the FMECA produced by the Project in accordance with Section C.4.1.

C.4.5 The FMECA for each potential failure mode for each Asset type shall include:

(a) the function of the Asset;

(b) the potential failure mode identified with an appropriate 'failure code';

(c) the potential effect of the failure; and

(d) the recommended critical spare parts.

C.5 Suppliers

C.5.1 For each Asset and all associated components, Design Builder shall provide a schedule of equipment suppliers, as existing at the time of commissioning, which shall contain:

(a) relevant City Materials Management award reference number (e.g. 659-2018); and

(b) supplier contact details (name, address, e-mail address, telephone numbers, etc.).

C.6 Recommended Predictive and Preventative Maintenance

C.6.1 Design Builder shall provide information regarding maintenance benchmarks for all Assets in the Asset Registry using the maintenance benchmark template provided in Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry, Attachment 2 – O&M Information Templates.

C.6.1.1 Maintenance benchmark templates are used to generate work orders within the City's OWAM system. They are used primarily for setting up reoccurring preventive and predictive maintenance type work orders.

C.6.1.2 More than one maintenance benchmark may be required for each Asset in the Asset Registry.

SECTION B SAFETY MANAGEMENT DOCUMENTS

C.7 General Requirements

C.7.1 Design Builder shall provide the following for all work activities relating to maintenance or operation of the Infrastructure that contain a potential hazard to plant staff or that require specific knowledge not generally in domain knowledge or are not readily obvious to new plant staffs.

(a) Safe Work Procedures (SWP);

(b) Standard Operating Procedures (SOP); and

(c) Lock Out – Tag Out Procedures (LOTO).

C.7.2 The SOP, SWP and LOTO procedure are collectively known as safety management documents in this Appendix 18F.

C.7.3 Design Builder shall develop the safety management documents in accordance with Appendix 18F – Attachment 1 - Guideline to Create Safety Management Documents.

C.7.3.1 Job hazard analysis as indicated in Appendix18F - Attachment 1 - Guideline to Create Safety Management Documents are required to develop SWPs.

C.7.4 Design Builder shall include training on the safety management documents in the Training Program, as per Schedule 18 – Technical Requirements – Appendix 18G – Training Requirements.

C.7.5 Safety management documents shall be unique across the NEWPCC facility and not be duplicated in the Existing Infrastructure. Design Builder shall coordinate with the City as required ensuring that the safety management documents are appropriately integrated with the City's existing procedures. Including, but not limited to, modifying and updating existing safety management documents.

C.7.6 As part of the development process for the safety management documents, Design Builder shall include input and review from a variety of Design Builder personnel familiar with the task or activity in order to reduce the possibility of overlooking steps or potential hazards and increase the likelihood of identifying the most appropriate measures to eliminate or control hazards. Design Builder shall include design engineers as applicable.

C.8 Deliverables

C.8.1 Design Builder shall provide a list of all SWP, SOP and LOTO procedure documents applicable to the Infrastructure. The list shall include:

(a) the name of the SWP, SOP and LOTO;

(b) whether the SWP, SOP and LOTO is new, existing, or modified;

(c) sufficient information on the hazard and procedures to evaluate the scope of the SWP, SOP and LOTO documents; and

(d) for existing SWP SOP and LOTO documents, any proposed modifications.

C.8.2 Prior to fully developing the SWP, SOP and LOTO documents; and 30 Calendar Days prior to submission of the Draft O&M Information, Design Builder shall submit the SWP, SOP and LOTO listing and receive an endorsement of “Received" or "Observations", in accordance with Schedule 5 – Review Procedure. The purpose of this review is to help ensure that the proposed SWP, SOP and LOTO documents are well aligned with the City’s systems and existing SWP, SOP and LOTO documents.

(a) Design Builder shall integrate comments from the City into the proposed SWP, SOP and LOTO documents.

C.8.3 Design Builder shall provide each of the safety management documents as individual files in both Microsoft Word and PDF format.

C.9 Material Provided by the City

C.9.1 The City will provide copies of existing SWP, SOP and LOTO procedure documents that could potentially be applicable to the Works at Design Builder's request.

C.9.2 The provision of the existing SWP, SOP and LOTO procedure documents by the City, or lack thereof, shall in no way limit Design Builder's responsibility to provide complete SWP, SOP and LOTO documents.

C.9.3 The City will provide the SWP, SOP and LOTO procedure Template in native format to Design Builder at Design Builder's request.

C.10 City Review

C.10.1 Submit all safety management documents in accordance with Section B.3.

C.10.2 Job hazard analysis shall accompany every Safe Work Proceedure

SECTION D AREA MANUAL

D.1 General

D.1.1 Provide a set of manuals (the "**Area Manuals**") as part of the O&M Information to comprehensively describe each area of the Infrastructure and provide comprehensive guidance to City staff on the operation of the Infrastructure.

D.1.2 For clarity, the Area Manuals shall provide an introduction of each area of the Infrastructure.

D.1.3 The Area Manuals shall comply with the requirements of Section B.5.

D.2 Organization

D.2.1 The Area Manuals shall include the following sections:

(a) introduction, in accordance with Section D.3;

(b) general process requirements, in accordance with Section D.5;

(c) building mechanical, in accordance with Section D.7;

(d) electrical, in accordance with Section D.8;

(e) automation, in accordance with Section D.9;

(f) functional Requirements in accordance with D.10;

(g) lubricant Schedule in accordance with Section **Error! Reference source not found.**;

(h) settings in accordance with Section **Error! Reference source not found.**; and

(i) appendices, in accordance with Section D.11.

D.3 Introduction

D.3.1 The introduction of each Area Manual shall include:

(a) a comprehensive description of the Infrastructure; including figures to describe the process schematically and by location. Include references to the process flow diagrams.

(b) a high level description of the infrastructure within the area including:

(i) key data; and

(ii) major capacities;

(c) location within the overall NEWPCC facility;

(i) provide a full 8.5” x 11” page key plan figure indicating the applicable area within the NEWPCC facility;

(d) a general description of the layout, including:

(i) building/structure layout and arrangement; and

(ii) location of the major processes and systems;

(e) Simplified floor plan layouts of each level of all structures. The purpose of these layouts shall be to aid new City staff in navigating the area and understanding the general purpose of each room. These layouts shall:

(i) show the rooms, room numbers and names;

(ii) show major processes and systems. For example, the switchgear within an electrical room shall be displayed, but not the lighting or receptacles;

(iii) avoid displaying dimensions or any other details that are distracting from the primary purpose of the floor plan layouts; and

(iv) be scaled to fit on a full 8.5” x 11” page or on an 11” x 17” foldout;

D.4 Health and Safety

D.4.1 For each area, provide comprehensive health and safety information, including identification of hazards and a description of the hazard controls for the specific area. Hazards, as applicable, shall include the following items:

(a) safety data sheets;

(i) provide an index of all applicable SDS; and

(ii) provide the SDS in PDF format;

(b) compressed gases;

(c) confined spaces;

(d) electrical shock and arc flash;

(e) explosive atmospheres;

(f) falls and trips;

(g) hazardous gases;

(h) hazardous materials;

(i) manual handling;

(j) noise;

(k) overhead cables;

(l) pressurized systems;

(m) stored mechanical energy;

(n) temperature; and

(o) traffic.

D.4.2 For each health and safety hazard, Design Builder shall:

(a) identify and clearly describe the hazard;

(b) provide figures to clearly identify the hazards and their potential locations;

(c) if appropriate and helpful to City personnel, provide references to drawings that help identify the hazard or the location of the hazard. The references to drawings shall not eliminate the requirement to provide figures;

(d) clearly describe the hazard controls, including the operation of the hazard control systems, as applicable;

(e) describe the design features of the infrastructure that have been used to mitigate each of the identified health and safety hazards;

(f) explain the hierarchy of controls applied to mitigate the hazard. For example:

(i) engineering controls;

(ii) administrative controls; and

(iii) PPE controls;

(g) identify precautions to take while working in the area; and

(h) identify and reference the applicable SWPs associated with each hazard.

D.4.3 Without limiting any other requirement, the Area Manuals shall include sections on the following:

(a) confined spaces:

(i) provide figures clearly identifying the confined spaces and the associated hazards;

(b) electrical hazards:

(i) provide figures clearly identifying the specific electrical hazards and the required safety systems that are not generally covered under the Area Manual. For example, general electrical hazards associated with a motor control centre may be located in the Area Manual; however, specific hazards associated with overhead power lines shall be included in the Area Manual;

(c) explosive atmospheres (as applicable):

(i) identify all hazardous locations in both table and figure format;

(ii) reference the applicable hazardous location plan drawings identifying hazardous (electrical) locations in accordance with the *WWD Electrical Design Guide* in Appendix 18D – City Standards;

(iii) identify and describe requirements for portable gas detection; and

(iv) identify and describe fixed controls, including ventilation systems, gas detection systems, electrical classification, interlock systems and other controls to mitigate the hazards;

(d) fall protection:

(i) provide figures clearly identifying the hazards associated with work at heights and the required safety controls;

(e) fire protection:

(i) portable fire extinguishers:

(A) include the following text: “Refer to the NEWPCC Fire Safety Plan for type and location of portable fire extinguishers.”;

(ii) fixed fire protection systems:

(A) include the following text: “Refer to the NEWPCC Fire Safety Plan for type and location of fixed fire protection systems.”

(iii) update the applicable sections of the NEWPCC Fire Safety Plan in accordance with Schedule 18;

(f) toxic atmospheres (as applicable):

(i) identify and describe requirements for portable gas detection; and

(ii) identify and describe fixed controls, including ventilation systems, gas detection systems, electrical classification, interlock systems and other controls to mitigate the hazards;

(g) other safety issues, precautions and equipment.

D.4.4 Design Builder shall include a summary of all statutory and safety and health signage included in the design, including the installed locations.

D.5 Simplified Process & Instrumentation Diagrams

D.5.1 Design Builder shall prepare simplified P&IDs that are similar to Design Builder’s P&ID drawings for inclusion in the Area Manuals with the following differences:

(a) format the simplified P&IDs as a figure in accordance with Section B.10;

(b) remove extraneous information, including most title block information; and

(c) remove all interlocks and automation, except for base instrument.

D.6 General Process Requirements

D.6.1 The requirements of Section D.5 shall apply to all processes and systems within the Infrastructure, including:

(a) process systems;

(b) building mechanical systems;

(c) electrical systems; and

(d) automation systems.

D.6.2 Design Builder shall begin each section with an introductory general description of the processes / systems within the section. The reader should not need to read the whole section to gain a general understanding of the scope of the section.

D.6.3 For each process and system, Design Builder shall provide the following as applicable:

(a) a description of the process/system along with the process/system objectives including:

(i) purpose;

(ii) capacities; and

(iii) inputs and outputs;

(b) a description of all major equipment and components, including appropriate identification to reference the Assets;

(c) key design criteria;

(d) the process control narratives, including control philosophy in manual and automatic modes;

(e) instructions on the use of manual controls;

(f) description of the process control parameters, settings, alarms and setpoints along with typical values and instructions on when to change;

(g) Process troubleshooting guides;

(h) descriptions of protection systems installed;

(i) emergency shut down and power failure procedures;

(j) sampling and analysis requirements;

(k) a description of electrical systems that are specific to the process / system; and

(l) a basic description of the automation systems specifically related to the process / system.

D.6.4 Design Builder shall create SOPs in accordance with Attachment 1 - Guideline to Create Safety Management Documents. Design Builder shall reference applicable SOPs inline in text, and in a summary table for each process / system. For clarity, the actual SOPs should be included in an appendix to the Area Manual, and not inline.

(a) SOPs shall include, but not be limited to, the following as applicable

(i) Provide list of SOP’s for initial review,

(ii) routine operational checks, including daily, weekly and monthly;

(iii) start-up;

(iv) shutdown;

(v) isolating; and

(vi) draining.

(vii) chemical tank filling

(b) a meeting is recommended with City staff to help develop the list of SOPs required

D.6.5 Design Builder shall provide a comprehensive overview of the SWPs, SOPs, and LOTO provided for each area without repeating the content of each document. Design Builder shall include applicable contextual and operational information that may not be clear from, or included in, the SOPs. Design Builder shall:

(a) provide sufficient information to allow the reader to understand the overall methods for operating the infrastructure.

(b) reference the specific SWPs, SOPs & LOTO and when they would be used.

(c) the inclusion of information in this section in no way reduces the requirement for information to be contained within the SOPs.

(d) reference applicable SWPs, SOPs & LOTO inline in text, and in a summary table for each process / system.

(e) ensure that Area Manuals are written in a cohesive manner.

D.6.6 Design Builder shall provide comprehensive instructions on the remote monitoring and operation of the building mechanical systems from the PCS. Design Builder shall:

(a) describe all modes of operation and provide instructions on changing between modes;

(b) identify and provide guidance on all adjustable control parameters, settings and setpoints;

(c) describe all automatic sequences and the manual sequences required should the automatic sequence fail;

(d) describe interlocks from an operational perspective. Describe all major interlocks and interlocks between equipment, but common inter-equipment interlocks may not require detailing if not beneficial to Operations Personnel. For example, a detailed interlock that the pump output contact should be turned off if the auxiliary input contact is released does not need to be included;

(e) provide screenshots of applicable PCS HMI screens along with guidance on use. Descriptions on use of the PCS should not be repetitive of common functionality, but rather should be written from the perspective of instruction of personnel. For example, do not repeat basic instructions such as “click on the symbol to open the faceplate”, but rather include instructions such as “In the event of a power failure on Bank 1, the breaker controls on faceplate SGR-E7110.CB-T will…”; and

(f) identify and describe high level alarms, including the exact wording / tag provided on the HMI. Describe the cause of the alarm, actual or potential consequences, and the required responses of the operator (cause, consequence and action).

D.6.7 Design Builder shall provide references to process flow diagrams and P&IDs located in the Drawing Manuals.

D.6.8 Design Builder shall provide operational troubleshooting guides for each process / system.

(a) the troubleshooting guide shall incorporate comprehensive instructions on dealing with and treating the failure of important parts of the process (e.g. power failure, air failure, major equipment failures) that if left unchecked, have the potential for the process to go out of specification or cause an incident; and

(b) maintenance troubleshooting should be included within the Maintenance Manuals.

D.6.9 Design Builder shall include a subsection for each process / system to provide applicable, specific safety information, including safety hazards and safety controls.

D.6.10 Design Builder shall provide all applicable SWPs in accordance with SECTION B. For clarity, SWPs shall not be provided within the Area Manuals, but shall be referenced from the Area Manuals. Design Builder shall:

(a) reference applicable SWPs inline in text, and in a summary table for each process / system; and

(b) ensure that the SWPs and Area Manuals are written in a cohesive manner.

D.7 Building Mechanical

D.7.1 Design Builder shall provide a section for each area clearly describing the building mechanical systems, including:

(a) sump pump systems;

(b) potable and non-potable water systems;

(c) flushing water systems, as applicable;

(d) compressed air systems, as applicable;

(e) HVAC;

(f) fire protection; and

(g) any other building mechanical system.

D.7.2 Design Builder shall ensure the requirements of Section D.5 are adhered to for all building mechanical systems.

D.7.3 Design Builder shall include key figures as appropriate to allow City staff to familiarize themselves with the building mechanical systems. Figures shall include:

(a) mechanical room layouts;

(b) layouts indicating the location and identification of all major HVAC components;

(c) layouts indicating the location and identification of all major fire protection components; and

(d) simplified P&IDs of all building mechanical systems.

D.7.4 Design Builder shall provide key design criteria, including:

(a) room ventilation rates in air changes per hour and flow rates; and

(b) indoor design temperatures.

D.8 Electrical

D.8.1 Design Builder shall provide a section for each area clearly describing the electrical systems, including:

(a) medium voltage distribution, including switchgear, transformers and interconnections;

(b) low voltage distribution, including switchgear, distribution panels, and transformers;

(c) MCCs;

(d) DC power supplies;

(e) power meters;

(f) uninterruptible power supplies;

(g) lighting control systems;

(h) public address systems;

(i) fire alarm systems;

(j) security systems; and

(k) other electrical distribution equipment.

D.8.2 Design Builder shall ensure the requirements of Section D.6 are adhered to for all electrical systems.

D.8.3 Design Builder shall provide a basic description of the electrical protection systems; however, a detailed description is not required in the Area Manuals.

D.8.4 Design Builder shall provide a description and operating instructions with respect to load shedding systems.

D.8.5 Design Builder shall specifically identify all electrical equipment with arc-flash energies of 8 cal/cm^2 or greater along with any special safety precautions.

D.8.6 Design Builder shall include key figures as appropriate to allow City staff to familiarize themselves with the electrical distribution system. Figures shall include:

(a) electrical room layouts showing layout and identification of all equipment;

(b) overview single line diagrams for each voltage level; and

(c) elevation figures for all motor control centres and other electrical distribution equipment that feeds equipment loads.

D.8.7 Design Builder shall provide key design criteria, such as major equipment ratings and capacities.

D.8.8 Design Builder shall provide information as required to ensure that any special requirements for lockout and tag out of process or mechanical systems is identified.

D.8.9 Design Builder shall provide instructions on the local operation of the electrical systems, including manual breaker and switch operation.

D.9 Automation

D.9.1 Design Builder shall provide a section for each area clearly describing the automation systems, including:

(a) PLC systems;

(b) HMI systems;

(c) historian systems;

(d) networking;

(e) automation panels; and

(f) other automation systems.

D.9.2 For clarity, the automation section(s) of the Area Manuals shall describe the general automation systems common and applicable to multiple systems. This section should not describe the specific automation components associated with a specific system, which should be described in the applicable section as described in Sections D.7 and D.8.

D.9.3 Design Builder shall ensure the requirements of Section D.5 are adhered to for all automation systems.

D.9.4 Design Builder shall provide a basic description of the architecture of the automation systems, as applicable to a general plant staff audience.

D.9.5 Design Builder shall include key figures as appropriate to allow City staff to familiarize themselves with the automation system. Figures shall include:

(a) applicable room layouts showing layout and identification of major equipment, including PLCs and HMIs; and

(b) overview automation architecture diagrams.

D.9.6 Design Builder shall provide instructions on use of the automation system, from an operations perspective.

D.10 Functional Requirements

D.10.1 Design Builder shall provide the functional requirements in accordance with the functional requirements specification(s) of the *WWD Wastewater Treatment Facilities Automation Design Guide* in Appendix 18D – City Standards.

D.11 Appendices

D.11.1 Design Builder shall include the following as an appendix to each Area Manual

(a) Commissioning Plan and Records

(i) Design Builder shall include the Final Commissioning Plan(s) (As-Built);

(ii) Design Builder shall include the Commissioning Records not associated with a specific Asset. Design Builder shall provide Asset-specific Commissioning Records in accordance with Section C.3;

(iii) the Commissioning Records shall include, but not be limited to, the following as applicable:

(A) certificates of acceptance from authorities having jurisdiction;

(B) Professional of Record letter(s) of certification;

(C) process commissioning results and reports;

(D) process performance tests certificates;

(E) structural test results;

(F) mechanical system commissioning results and reports;

(G) electrical system commissioning test results;

(H) power distribution system acceptance documentation;

(I) process control system factory acceptance test documentation;

(J) process control system site acceptance test documentation; and

(K) network commissioning documentation;

(iv) Design Builder shall provide all Commissioning Records in PDF format;

(b) HAZOP Records

(i) Design Builder shall include a copy of records from the HAZOP produced by the project; and

(ii) inclusion of the HAZOP records does not reduce the requirements for description of hazard controls in the Area Manuals or other O&M Information.

SECTION E OPERATION AND MAINTENANCE MANUALS

E.1 General

E.1.1 Design Builder shall provide manuals to comprehensively provide all routinely required information to allow City personnel to maintain the Infrastructure (the "**Operation and Maintenance Manuals**").

(a) for the purpose of the O&M Manuals, routinely required information shall include all information that:

(i) is useful to introduce City Maintenance Personnel to the maintenance of the processes, systems and Assets; and

(ii) is likely to be utilized by Maintenance Personnel on an annual or more frequent basis.

E.1.2 The Operation and Maintenance Manuals shall excerpt information from the Area Manual and Asset Information as required, such that routinely utilized information is provided in an organized and easy to understand manner.

E.1.3 The Operation and Maintenance Manuals shall comply with the requirements of Section B.5.

E.2 Organization

E.2.1 The electronic format and hardcopy format of the Maintenance Manuals shall be identical.

E.2.2 Design Builder shall organize the Maintenance Manuals by:

(a) Asset Area

(b) Asset Class Type, in accordance with Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry;

(c) Asset Class, in accordance with Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry;

(d) Asset Type, in accordance with Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry;

(e) manufacturer and model number (if applicable);

(f) if required, model series numbers (or other unique information as applicable); and

(g) equipment identifier, where the information is specific to the individual Asset.

E.3 Maintenance Benchmarks

E.3.1 Design Builder shall provide information regarding maintenance benchmarks for all Assets in the Asset Registry.

E.3.1.1 Design Builder shall consider the maintenance information from the manufacturer's literature, but the information should not be limited to the manufacturer's literature only. The maintenance activities shall be based upon the manufacturer's recommendations and include additional recommendations by Design Builder.

E.3.2 Design Builder shall:

(a) provide maintenance benchmarks that include all Asset Types, components and summary of required maintenance e.g. weekly, bi-weekly, monthly quarterly, semi-annually, yearly etc.;

(b) include Assets with equipment identifier and Assets without equipment identifiers such as architectural, structural and civil systems;

(c) assign a recommended frequency to all applicable Assets;

(d) organize maintenance benchmark work orders by Asset Type;

(e) provide an index which includes the maintenance benchmark and the associated Asset;

(f) include sufficient information in the maintenance benchmark work order templates to allow the Infrastructure to be maintained safely in a manner such that the design service life of each Asset is maintained; and

(g) include requirements for regular inspections by all trades, including plant operators.

E.4 Lubricants Schedule

E.4.1 For each Asset, Design Builder shall provide a complete schedule of all lubricants used for the Asset.

E.4.2 The lubricants schedule shall contain the following information:

(a) equipment identifier;

(b) Asset description (as per Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry);

(c) Asset location (as per Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry);

(d) lubricant description, including the product name, generic name, Society of Automotive Engineers grade, oil category, etc.; and

(e) manufacturer name.

E.5 Manufacturers' Literature

E.5.1 For each Asset, provide a complete set of manufacturer's literature, including all installation, operation and maintenance manuals.

E.5.2 The literature from manufacturer shall be specific to the equipment installed. Where manufacturers' literature contains information on multiple equipment types or variants, the specific equipment installed shall be clearly identified.

E.5.3 Manufacturer's literature shall include:

(a) product description, including:

(i) a brief description of the equipment and principles of operation;

(ii) design specifications (materials, weight, motor data, etc.);

(iii) approvals and certifications;

(iv) illustrations and general arrangements;

(v) reference data – all applicable technical and/or reference data for the specific equipment and components installed, including:

(A) manufacturer, model, serial number, size, power, rating etc.;

(B) pump and fan performance curves; and

(C) factory testing results (where applicable);

(vi) hard copies of original diagrams, drawings, pictures or other graphics; and

(vii) safety guidelines;

(b) transport and storage;

(c) installation and operating instructions. Provide comprehensive instructions, including diagrams, figures, and general arrangements for:

(i) installation;

(ii) programming (where applicable);

(iii) commissioning;

(iv) start-up (including calibrations, adjustments, alarming, etc.);

(v) operations; and

(vi) shutdown;

(d) Maintenance work instructions and comprehensive instruction, with detailed descriptions of all hazards and safety requirements, for:

(i) inspection;

(ii) routine maintenance;

(iii) removal and testing;

(iv) component overhaul and replacement;

(v) special handling techniques; and

(vi) special tools required.

(e) troubleshooting guide, including comprehensive set of troubleshooting scenarios to allow systematic identification of performance and functional problems for the equipment or system; and

(f) materials list, tools and equipment listing, including:

(i) for larger and/or more complex equipment (for example, a dewatering centrifuge, motor control centre, control panel, large air compressor, on-line analytical water quality instrumentation) a manufacturer's materials list and/or detailed parts diagram shall be provided referencing part numbers, descriptions, quantities and drawing numbers or other information references; and

(ii) comprehensive and complete listing of all special equipment and accessories.

E.6 Settings

E.6.1 For each Asset and all components, Design Builder shall provide a complete schedule of all technician and user settable settings, including all associated PCS settings and set points.

E.6.2 For each setting, Design Builder shall include:

(a) setting name or identifier;

(b) setting description;

(c) associated component (e.g. PT-S3251);

(d) location where setting is adjusted (e.g. pcs, ft-g1125); and

(e) final as-commissioned value.

E.7 Bill of Material and Warranty Information

E.7.1 For each Asset and components, use the bill of material template and warranty information template in Appendix 18F – Attachment 2 – O&M Information Templates to provide the following information:

(a) complete list of parts for each Asset, which are also identified on exploded view diagrams; and

(b) for each part, Design Builder shall provide:

(i) Asset Identification, as applicable and in accordance with Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry;

(ii) part description and material composition (e.g. stainless steel etc.);

(iii) original equipment manufacturer part number;

(iv) detailed specification of parts to allow for classification in OWAM;

(v) closest supplier, with complete contact information, and if they offer vendor managed inventory; and

(vi) alternate supplier with complete contact information.

E.7.2 Further to Section **Error! Reference source not found.**, information required for each part shall be consistent with the template provided.

E.8 Shop Drawings

E.8.1 For each Asset and all components, Design Builder shall provide all shop drawings and other submittals.

E.8.2 Design Builder shall provide document numbers in accordance with the *WSTP Project Document Numbering Standard* in Appendix 18D– City Standards.

E.9 Spare Parts and Maintenance Materials

E.9.1 Design Builder shall provide the following:

(a) list of spare parts and consumables that Design Builder will be providing to the City for use within 2 years after Final Completion; and

(i) indicate the number of spare parts and consumables, of each type, provided to the City;

(b) list of spare parts and consumables that the City will need to procure for use starting 2 years after Final Completion through the life cycle of all Assets;

(i) indicate the number of spare and consumables, of each type, expected to be used by the City throughout the life cycle of all Assets.

E.9.2 The spare parts and consumables list shall contain the following information equipment identifier;

(a) Asset description (as per Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry);

(b) Asset location (as per Schedule 18 – Technical Requirements – Appendix 18H – Asset Registry);

(c) spare part or consumable description (as per manufacturer's manual);

(d) equipment manufacturer's item number;

(e) original equipment manufacturer part number;

(f) supplier name, at time of commissioning and name of supplier that serves local Winnipeg market;

(g) estimated lead time for procurement; and

(h) reference to manufacturer's documentation.

E.9.2.1 The spare parts will need to be catalogued by building and placed in the storage equipment storage rooms provided.

E.10 Special Maintenance Procedures

E.10.1 Design Builder shall provide special maintenance procedures where not otherwise included. Design Builder shall provide procedures in a detailed step-by-step format, to allow for City Maintenance Personnel to successfully complete the task. Procedures shall include, but not be limited to:

(a) maintenance procedures for decommissioned assets and/or buildings;

(b) procedure for rebuilding server and operator workstation computers;

(c) black-start procedures in the event of DC battery depletion or failure;

(d) oil containment system routine maintenance; and

(e) oil containment spill response procedures.

E.11 Asset Index

E.11.1 For each manual, in addition to a table of contents, Design Builder shall provide an Asset index, with all Assets and components, to allow the user to identify the location of the corresponding Asset Information. For example, if an instrument is a component of an Asset, but the user only has the instrument identifier, this index would allow the user to quickly identify the applicable Asset Information.

E.11.2 The index shall be organized alphabetically by equipment identifier.

E.11.3 The index shall contain the following for each Asset:

(a) equipment identifier;

(b) Asset description;

(c) A cross-reference to the appropriate sections of the Operations and Maintenance Manual. The reference for hardcopy information shall include binder and internal divider tab information;

(i) Where no or partial maintenance information is provided in the Operations and Maintenance Manual for an Asset, due to the requirements of Section (a), inform the reader to reference the electronic Asset Information.

E.12 Content

E.12.1 Where meeting the requirements of Section (a), include the following from the Asset Information within the Maintenance Manuals:

(a) bill of material, as per Section **Error! Reference source not found.**;

(b) lubricants schedule, as per Section **Error! Reference source not found.**;

(c) manufacturers' literature, as per Section **Error! Reference source not found.**;

(d) settings, as per Section **Error! Reference source not found.**;

(e) shop drawings, as per Section **Error! Reference source not found.**;

(f) special maintenance procedures as per Section **Error! Reference source not found.**;

(g) suppliers, as per Section C.5;

(h) FMECA records, as per Section D.5; and

(i) health and safety in accordance with Section D.4.

E.13 Site Services

E.13.1 The Operation and Maintenance Manual shall also include site services information in accordance with Section **Error! Reference source not found.**.

SECTION F DRAWING SET

F.1 General

F.1.1 Design Builder shall provide a comprehensive set of drawings (the "**Drawing Set**") for use by City staff to operate and maintain the Infrastructure, organized by area.

F.2 Organization

F.2.1 Each Drawing Set shall include the following sections:

(a) index of drawings, in accordance with Section F.3; and

(b) drawings, in accordance with Section F.4.

F.2.2 References from O&M Manuals to drawings in the Drawings Set shall be made via relative electronic hyperlinks.

F.3 Index of Drawings

F.3.1 Design Builder shall provide an index of all drawings produced or revised as part of the Works. The index shall contain:

(a) drawing number;

(b) drawing title;

(c) discipline;

(d) type of drawing (corresponding with drawing number type code); and

(e) area (corresponding with Area Code).

F.3.2 The index shall be sorted by area, then discipline, then drawing number.

F.3.3 For clarity, Design Builder shall provide an index for each Drawing Set and each Drawing Set shall be comprised of the drawings for a specific area.

F.3.4 The index shall be provided in both hardcopy and electronic formats, with the electronic in Microsoft Excel format.

F.4 Drawings

F.4.1 Design Builder shall provide 1 complete set of As-Built Construction Drawings and Record Drawings over and above those sets required under Schedule 18.

Attachment 1 -
Guideline to Create Safety Management Documents

Attachment 2 – O&M Information Templates