

SUMMARY OF WORK

1. GENERAL

1.1 Summary

- .1 The completed Work will provide the City with a fully-functional Struvite Recovery System (SRS) for the North End Water Pollution Control Centre (NEWPCC).
 - .1 The Work generally includes
 - .1 Submittals, including approved shop drawings.
 - .2 Design support to the Contract Administrator.
 - .3 Programming support to the System Integrator.
 - .4 Validation of control system programming.
 - .5 Supply and delivery of a fully functional Struvite Recovery System.
 - .6 Design services for the pre-digestion release of phosphorus process.
 - .7 Training of the Installation Contractor and installation supervision and inspection.
 - .8 Commissioning services including managing performance testing.
 - .9 Operator training.
 - .10 Operation and Maintenance Manuals.
 - .11 Warranty.
 - .12 Purchase and removal of struvite produced by the Struvite Recovery System.
 - .2 Submittals
 - .1 Submit Submittals in accordance with Section 01 33 00, Submittal Procedures and these Specifications.
 - .3 Design Support
 - .1 Provide all supporting technical services and products described in these Specifications and the Contractor's Proposal, and that may be reasonably required by the Contract Administrator and the City. Design services shall include but are not necessarily limited to:
 - .1 Provide information relating to the Struvite Recovery System (including pre-digestion release of phosphorus process) and all ancillary equipment, including but not limited to Shop Drawings and preliminary layouts used for the preparation of design drawings to facilitate tendering of an installation and construction contract for the struvite recovery system at the NEWPCC.
 - .2 Provide operating and design process information including control philosophy, standard operating procedures, preventative maintenance schedule, equipment data and reference material.

SUMMARY OF WORK

- .3 Provide necessary performance specifications for all equipment and materials.
- .4 Programming Support
 - .1 Provide all supporting technical services and products described in these Specifications and that may be reasonably required by the system integrator.
- .5 Control System Validation
 - .1 Assist in the testing of the Struvite Recovery System programming.
- .6 Supply and Delivery of Struvite Recovery System equipment
 - .1 Supply and deliver a fully functional Struvite Recovery System.
 - .2 Provide appurtenances not specifically mentioned in the Contract but which are necessary as part of the Work to ensure that the equipment is fully functional.
- .7 Installation Support
 - .1 Provide all necessary instruction and supervision to ensure satisfactory off-loading, storage, and installation of equipment.
 - .2 Witness and certify equipment installation.
- .8 Commissioning Services
 - .1 Prepare and approved Commissioning and Performance Demonstration Plan.
 - .2 Participate in functional testing and management of performance testing.
- .9 Operator Training
 - .1 Provide training materials and training of the City's operations and maintenance staff.
- 2. **PRODCUCTS (NOT USED)**
- 3. **EXECUTION (NOT USED)**

END OF SECTION

SUBMITTAL PROCEDURES

1. GENERAL

1.1 Administrative

- .1 Submit to the Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present Shop Drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to the Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by the Contract Administrators review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by the Contract Administrators review.

1.2 Shop Drawings and Product Data

- .1 Submit drawings stamped and signed by a professional engineer registered or licensed in the Province of Manitoba.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow fourteen (14) Calendar Days for Contract Administrators review of each submission.
- .4 Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If adjustments affect value of the Work, state such in writing to the Contract Administrator prior to proceeding with the Work.

SUBMITTAL PROCEDURES

- .5 Make changes in Shop Drawings as the Contract Administrator may require, consistent with the Contract Documents. When resubmitting, notify the Contract Administrator in writing of revisions other than those requested.
- .6 Accompany submissions with transmittal letter containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each Shop Drawing, product data and sample.
 - .5 Other pertinent data.
- .7 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with the Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.

SUBMITTAL PROCEDURES

- .10 Relationship to adjacent work.
- .8 After the Contract Administrators review, distribute copies.
- .9 Submit five (5) copies of Shop Drawings and one (1) electronic copy for each requirement requested in Specification Sections and as the Contract Administrator may reasonably request.
- .10 Submit five (5) copies of product data sheets or brochures and one (1) electronic copy for requirements requested in Specification Sections and as requested by the Contract Administrator where Shop Drawings will not be prepared due to standardized manufacture of product.
- .11 Submit five (5) copies of test reports and one electronic copy for requirements requested in Specification Sections and as requested by the Contract Administrator.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
- .12 Submit five (5) copies of certificates and one electronic copy for requirements requested in Specification Sections and as requested by the Contract Administrator.
 - .1 Statements printed on Manufacturer's letterhead and signed by responsible officials of Manufacturer of the Product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of Contract complete with project name.
- .13 Submit five (5) copies of Manufacturer's instructions and one electronic copy for requirements requested in Specification Sections and as requested by Contract Administrator.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .14 Submit five (5) copies of Manufacturer's Field Reports and one electronic copy for requirements requested in Specification Sections and as requested by the Contract Administrator.
- .15 Documentation of the testing and verification actions taken by Manufacturer's Representative to confirm compliance with Manufacturer's standards or instructions.
- .16 Submit five (5) copies of Operation and Maintenance Data and one electronic copy for requirements requested in Specification Sections and as requested by the Contract Administrator.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.

SUBMITTAL PROCEDURES

- .19 If upon review by the Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, one (1) copy will be returned and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and resubmission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .20 The review of Shop Drawings by the Contract Administrator is for the sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that the City approves detail design inherent in Shop Drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in Shop Drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of Subcontractors.

1.3 Samples

- .1 Submit for review samples in duplicate as requested in respective Specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to the Contract Administrator business address.
- .3 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by the Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to the Contract Administrator prior to proceeding with Work.
- .6 Make changes in samples which the Contract Administrator may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

2. PRODUCTS (NOT USED)

3. EXECUTION (NOT USED)

END OF SECTION

FIELD SERVICES

1. GENERAL

1.1 Submission

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 At least thirty (30) Calendar Days prior to commencing equipment performance verification and process performance verification, the Contractor with information from the Installation Contractor shall submit a detailed start-up plan to indicate the schedule and sequence of equipment installation checks and tests required for the Contract Administrator's review and input. No testing work can commence until this plan has been discussed by all parties involved and accepted by the Contract Administrator.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made; indicate deficiencies and corrective action taken.

1.2 Delivery of Equipment

- .1 The Contractor shall coordinate the date of major equipment delivery close to the time the equipment will be installed (and within approved equipment delivery schedule time frame). A representative from each of the following groups will be in attendance at the time of delivery:
 - .1 The Contractor
 - .2 The Installation Contractor
- .2 The Installation Contractor will be responsible for receiving, off-loading, and placing into storage all equipment at the site. **Form 100**, "Certificate of Equipment Delivery," shall be completed.

1.3 Installation Assistance

- .1 Before commencing installation of equipment, the Installation Contractor will arrange for the attendance of the Manufacturer's Representative to provide instructions in the methods, techniques, precautions, and any other information relevant to the successful installation of the equipment.
- .2 The Contractor shall inform the Contract Administrator, in writing, of the attendance at the site of any Manufacturer's Representative for installation training at least fourteen (14) Calendar Days prior to arrival.
- .3 When the Manufacturer's Representative is satisfied that the Installation Contractor is aware of all installation requirements, he shall so certify by completing **Form 101**, "Certificate of Equipment Installation," attached to this specification.
- .4 The completed form shall be delivered to the Contract Administrator prior to departure of the Manufacturer's Representative from the site.
- .5 Installation of the equipment shall not commence until the Contract Administrator has advised that he has received the completed **Form 101**.
- .6 Separate copies of **Form 101** shall be used for different equipment.

FIELD SERVICES

2. EXECUTION

2.1 Installation

- .1 If necessary, or if so directed by the Contract Administrator during the course of installation, the Installation Contractor will contact the Contractor to receive clarification of installation procedures, direction, or any other additional information necessary to continue or complete the installation in an appropriate manner.
- .2 If it is found necessary, or if so directed by the Contract Administrator, the Installation Contractor will arrange for the Manufacturer's Representative to visit the site to provide assistance during installation, all at no cost to the City.
- .3 Prior to completing installation, the Installation Contractor will inform the Manufacturer and arrange for the attendance at the site of the Manufacturer's Representative to verify successful installation at the Installation Contractor's expense.

2.2 Installation Verification

- .1 The Manufacturer's Representative shall conduct and document a detailed inspection of the installation including alignment, electrical connections, instrumentation, control systems, safety equipment, belt tensions, rotation direction, running clearances, lubrication, workmanship and all other items as required to ensure successful operation of the equipment. The City's personnel should actively be involved to ensure they understand how each item of equipment is checked to ensure proper installation, alignment, or any other special requirements prior to start-up.
- .2 The Manufacturer's Representative shall identify any outstanding deficiencies in the installation and shall provide a copy of the Site Inspection Report to the Contract Administrator.
- .3 The deficiencies will be rectified by the Installation Contractor and the Manufacturer's Representative shall re-inspect the installation, at no cost to the City. A Formal Inspection Report must be provided to the Contract Administrator after final inspection.
- .4 When the Manufacturer's Representative accepts the installation, he shall certify the installation by completing **Form 102**, "Certificate of Satisfactory Equipment Installation," attached to this specification. **Form 102** can be signed off with the understanding that minor deficiencies are to be corrected prior to the start of the operation and performance verification (**Form 103**).
- .5 Deliver the completed **Form 102** to the Contract Administrator prior to departure of the Manufacturer's Representative from the Site.
- .6 Tag the equipment with a 100 mm x 200 mm card stating "Equipment Checked. Do Not Run." stenciled in large black letters. Sign and date each card.
- .7 Provide separate copies of **Form 102** for different equipment.

2.3 Operation and Performance Verification

- .1 Equipment will be subjected to a demonstration, running test, and performance tests after the installation has been verified and any identified deficiencies have been remedied.

FIELD SERVICES

- .2 Inform the Contract Administrator at least fourteen (14) Calendar Days in advance of conducting the tests and arrange for the attendance of the Manufacturer's Representative. The tests may be concurrent with the inspection of satisfactory installation if mutually agreed by the Installation Contractor, Contractor, and the Contract Administrator.
- .3 A copy of the equipment operations manuals shall be provided a minimum of thirty (30) Calendar Days prior to commencement of the Equipment Performance Test.
- .4 The Manufacturer's Representative shall conduct all necessary checks to equipment and if necessary, advise the Installation Contractor of any further checking, flushing, cleaning, or other work needed prior to confirming the equipment is ready to run.
- .5 The Installation Contractor will then notify the Contract Administrator of his readiness to demonstrate the operation of the equipment. The Contract Administrator will attend, as expeditiously as possible.
- .6 With the assistance of the Manufacturer's Representative, the Installation Contractor will demonstrate that the equipment is properly installed. Alignment, piping connections, electrical connections, etc. will be checked and if appropriate, code certifications provided.
- .7 The equipment will then be run for one (1) hour. Local controls will be satisfactorily verified by cycling the equipment through several start-stop operations, modulating its output, or some combination. Operating parameters such as temperature, pressure, voltage, vibration, etc., will be checked to ensure that they are within the specified or Manufacturer's recommended limits, whichever is more stringent.
- .8 On satisfactory completion of the one (1) hour demonstration, the equipment will be stopped and critical parameters, such as alignment, will be rechecked. Any remedial measures required to ensure satisfactory operation shall be promptly undertaken.
- .9 The equipment will be restarted and run continuously for five (5) Calendar Days in coordination under the commissioning plan. During this period, as practicable, conditions will be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed by the Manufacturer's Representative, the Installation Contractor, and Contract Administrator on the basis of the information contained in the technical specifications, as well as the methods utilized to create the simulated conditions and the time periods allotted to each.
- .10 Performance tests will be conducted either concurrent with or subsequent to the running test, as practicable and agreed between the Contract Administrator, the Contractor and the Installation Contractor. Performance tests of equipment will be carried out jointly with the City's Supervisory Control and Data Acquisition (SCADA) programming team. Instrumentation and Controls (I&C) connected to the marshalling panel shall include, but not to be limited to, simulation through SCADA. Performance tests will also be attended by the City's operations staff as part of the acceptance procedure. Testing procedures and conditions shall be agreed to among the Contractor, Contract Administrator, and the City based on information in the specification. The Contract Administrator is the final arbiter. However, the Contractor and Installation Contractor are responsible for conducting the tests.
- .11 Performance tests shall be as dictated in the technical specifications for each item of equipment or as reasonably required by the Contract Administrator to prove adherence to the requirements listed in the specification.

FIELD SERVICES

- .12 The Contractor shall submit the results of the performance tests to the Contract Administrator, documented and summarized in a format acceptable to the Contract Administrator. The Contract Administrator reserves the right to request additional testing. No equipment shall be accepted and handed over to the City prior to the satisfactory completion of the performance test(s) and receipt of the test reports.
- .13 All water, temporary power, heating, or any other ancillary services required to complete the initial demonstration, running test, and performance tests are the responsibility of the Installation Contractor. Chemicals are to be provided by the Contractor.
- .14 Should the initial demonstration, running test, or performance tests reveal any defects, then those defects shall be promptly rectified and the demonstration, running tests, and/or performance tests shall be repeated to the satisfaction of the Contract Administrator. Additional costs incurred by the Installation Contractor, the Contract Administrator, or the City, due to repeat demonstration, running tests, and/or performance tests shall be the responsibility of the Contractor .
- .15 On successful completion of the demonstration, running test, and performance tests, **Form 103**, "Certificate of Equipment Satisfactory Performance," attached to this specification shall be signed by the Manufacturer's Representative, the Installation Contractor, and the Contract Administrator. **Form 103** can be signed off with the understanding that minor deficiencies are to be corrected prior to the start of the system test (**Form 104**).
- .16 No equipment shall be accepted and handed over to the City prior to satisfactory completion of the Equipment Performance Test(s) and acceptance of the test reports by the Contract Administrator.
- .17 Tag the equipment with a 100 mm x 200 mm card stating "Equipment Performance Checked. Do Not Run." stenciled in large black letters. Sign and date each card.
- .18 Provide separate copies of **Form 103** for different equipment.

FIELD SERVICES

**CERTIFICATE OF EQUIPMENT DELIVERY
FORM 100**

We certify that the equipment listed below has been delivered into the care of the Installation Contractor. The equipment has been found to be in satisfactory condition. No defects in the equipment were found.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

(Authorized Signing Representative of the Contractor (Supplier))

Date

(Authorized Signing Representative of Installation Contractor)

Date

FIELD SERVICES

**CERTIFICATE OF EQUIPMENT INSTALLATION
FORM 101**

I have familiarized the Installation Contractor of the specific installation requirements related to the equipment listed below and am satisfied that he understands the required procedures.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

(Authorized Signing Representative of the Contractor (Supplier)) Date

I certify that I have received satisfactory installation instructions from the equipment Manufacturer/
Contractor.

(Authorized Signing Representative of the Installation Contractor) Date

FIELD SERVICES

**CERTIFICATE OF SATISFACTORY INSTALLATION
FORM 102**

I have completed my check and inspection of the installation listed below and confirm that it is satisfactory and that defects have been remedied to my satisfaction except any as noted below:

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

OUTSTANDING DEFECTS: _____

(Authorized Signing Representative of the Contractor (Supplier))

Date

(Authorized Signing Representative of the Installation Contractor)

Date

FIELD SERVICES

**CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE
FORM 103**

We certify that the equipment listed below has been continuously operated for at least five (5) consecutive Calendar Days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG No: _____

**REFERENCE
SPECIFICATION:** _____

(Authorized Signing Representative of the Contractor (Supplier)) Date

(Authorized Signing Representative of the Installation Contractor) Date

(Authorized Signing Representative of the Contract Administrator) Date

CLOSEOUT PROCEDURES

1. GENERAL

1.1 Inspection and Declaration

- .1 Contractor's Inspection: Contractor and Installation Contractor: conduct inspection of the Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify the Contract Administrator in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made.
 - .2 Request the Contract Administrator's Inspection.
- .2 Contract Administrator's Inspection: the Contract Administrator, Contractor and Installation Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. Contract Administrator will determine responsibility to correct Work.
- .3 Completion: submit written certificate that the following have been performed:
 - .1 Work has been completed and inspected for compliance with the Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Any Certificates required by authorities having jurisdiction have been submitted.
 - .5 Operation of systems have been demonstrated to the City's personnel.
 - .6 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by, Contract Administrator, Contractor and Installation Contractor. If Work is deemed incomplete by the Contract Administrator, complete outstanding items and request re-inspection.
- .5 Certificate of Substantial Performance: when the Contract Administrator considers deficiencies and defects have been corrected and it appears requirements of the Contract have been substantially performed, make application for certificate of Substantial Performance.

2. PRODUCTS (NOT USED)

3. EXECUTION (NOT USED)

END OF SECTION

CLOSEOUT SUBMITTALS

1. GENERAL

1.1 Submittals

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare instructions and data using personnel experienced in the maintenance and operation of described products.
- .3 A copy will be returned after final inspection with the Contract Administrator's comments.
- .4 Revise the content of the documents as required prior to final submittal.
- .5 Four (4) weeks prior to commissioning of the Work, submit to the Contract Administrator six (6) final paper copies of the Operating and Maintenance (O&M) Manuals and one (1) electronic copy (PDF) on CD OR DVD in SI units.
- .6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of the same quality and manufacture as the products provided in Work.
- .7 Furnish evidence, if requested, for type, source and quality of the products provided.

1.2 Format

- .1 Organize data as an instructional manual.
- .2 Binders shall be vinyl, hard covered, 3 'D' ring, loose leaf with spine and face pockets. The maximum width of each binder shall not exceed 125 mm; where there is more data than will fit in a binder of 125 mm maximum width, the number of binders shall be as required.
- .3 When multiple binders are used, correlate the data into related consistent groupings. Identify contents of each binder on the spine.
- .4 Covers shall be used to identify each binder with type or printed title "Operation and Maintenance Manual"; list date, title of project, Contractor and Contract Administrator, and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 The text shall be manufacturer's printed data, or typewritten data.
- .8 Drawings shall be provided with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on CD or DVD.
- .10 Provide one (1) electronic copy (on CD or DVD) of the entire manual.

CLOSEOUT SUBMITTALS

1.3 Contents - Each Volume

- .1 Table of Contents: provide title of project
 - .1 Date of submission; names
 - .2 Addresses and telephone numbers of the Contract Administrator and Contractor with the names of responsible parties
 - .3 Schedule of products and systems, indexed to content of volume
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts
 - .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
 - .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Drawings larger than 210 mm x 300 mm (A4) shall be contained in plastic pouch. Provide a separate panel for each drawing.
 - .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
 - .6 Training: refer to Section 01 91 41 - Commissioning Training.

1.4 As-Builts and Samples

- .1 Maintain for the Contract Administrator one record copy of:
 - .1 Drawings
 - .2 Specifications
 - .3 Addenda
 - .4 Change Orders and other modifications to Contract
 - .5 Reviewed Shop Drawings, product data, and samples
 - .6 Field test records
 - .7 Inspection certificates
 - .8 Manufacturer's certificates
- .2 Label record documents and file in accordance with Section number listings in the List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

CLOSEOUT SUBMITTALS

- .3 Maintain record documents in clean, dry and legible condition.
- .4 Keep record documents and samples available for inspection by the Contract Administrator.

1.5 Recording Actual Site Conditions

- .1 Record information on set of black line opaque drawings, provided by the Contract Administrator.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Contract Drawings and Shop Drawings: mark each item to record actual construction, including:
 - .1 Changes made by Change Orders.
 - .2 Details not on original Contract Drawings.
 - .3 References to related Shop Drawings and modifications.
- .4 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Change Orders.
- .5 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records as required by individual Specifications Sections.

1.6 Equipment and Systems

- .1 Each Item of Equipment and Each System: include the description of the unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel Board Circuit Directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide a servicing and lubrication schedule, and a list of lubricants required.

CLOSEOUT SUBMITTALS

- .7 Include Manufacturer's printed O&M instructions.
- .8 Include the sequence of operation by the controls Manufacturer.
- .9 Provide original Manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by the controls Manufacturer.
- .11 Provide the Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with the location and function of each valve, keyed to flow and control diagrams.
- .13 Provide a list of original Manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test reports as specified in Section 01 91 31
- .15 Additional requirements: as specified in individual Specification Sections.

1.7 Materials and Finishes

- .1 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .2 Additional Requirements: as specified in individual Specifications Sections.

1.8 Spare Parts

- .1 Provide spare parts, in quantities specified in Contract Documents.
- .2 Provide items of the same manufacture and quality as items in the Work.
- .3 Deliver to Site; place and store.
- .4 Submit inventory listing to the Contract Administrator. Include approved listings in O&M Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.9 Maintenance Materials

- .1 Provide maintenance and extra materials, in quantities specified in Contract Documents.
- .2 Provide items of the same manufacture and quality as items in the Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items. Submit inventory listing to the Contract Administrator. Include approved listings in the O&M Manual.

CLOSEOUT SUBMITTALS

- .5 Obtain receipt for delivered products and submit prior to final payment.

1.10 Special Tools

- .1 Provide special tools, in quantities specified in individual Specification Section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to site.
- .4 Receive and catalogue items. Submit inventory listing to the Contract Administrator. Include approved listings in the O&M Manual.

1.11 Warranties and Bonds

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, thirty (30) Calendar Days before planned pre-warranty conference, to Contract Administrator approval.
- .3 Warranty management plan to include required actions and documents to assure that the Contract Administrator receives warranties to which it is entitled.
- .4 Provide the plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit warranty information made available during the construction phase, to the Contract Administrator for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder and submit upon acceptance of work. Organize the binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing.
 - .2 List Subcontractor and Manufacturer, with name, address, and telephone number of responsible principals.
 - .3 Obtain warranties and bonds, executed in duplicate by Subcontractors and Manufacturers, within ten (10) Calendar Days after completion of the applicable item of Work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .7 Conduct a joint twenty-one (21) month warranty inspection, measured from the time of acceptance, by the Contract Administrator.

CLOSEOUT SUBMITTALS

- .8 Include information contained in the warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of Contractors, Subcontractors, Manufacturers or suppliers involved.
 - .2 Provide a list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item
 - .2 Model and serial numbers
 - .3 Location where installed
 - .4 Name and phone numbers of Manufacturers or Subcontractor
 - .5 Names, addresses and telephone numbers of sources of spare parts
 - .6 Warranties and terms of warranty: Indicate items that have extended warranties and show separate warranty expiration dates
 - .7 Cross-reference to warranty certificates as applicable
 - .8 Starting point and duration of the warranty period
 - .9 Summary of maintenance procedures required to continue warranty in force
 - .10 Cross-Reference to specific pertinent O&M Manuals
 - .11 Organization, names and phone numbers of persons to call for warranty service
 - .12 Typical response time and repair time expected for various warranted equipment
 - .3 Contractor's plans for attendance at the twenty-one (21) month post-construction warranty inspections.
 - .4 Procedure and status of tagging equipment covered by extended warranties.
 - .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .9 Respond in a timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification will follow oral instructions. Failure to respond will be cause for the Contract Administrator to proceed with action against the Contractor.

1.12 Warranty Tags

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by the Contract Administrator.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.

CLOSEOUT SUBMITTALS

- .3 Leave the date of acceptance until project is accepted for occupancy.
- .4 Indicate the following information on the tag:
 - .1 Type of product/material
 - .2 Model number
 - .3 Serial number
 - .4 Contract number
 - .5 Warranty period
 - .6 Inspector's signature
- 2. **PRODUCTS (NOT USED)**
- 3. **EXECUTION (NOT USED)**

END OF SECTION

COMMISSIONING

1. GENERAL

1.1 General

- .1 At the time of the commissioning, the Contract Administrator shall advise the Contractor of the commissioning requirements. These requirements are dependent on the anticipated operational requirements of the City's wastewater system to meet the demands at the time.
- .2 The Contractor shall refer to all Divisions for details on the commissioning procedures not included in this Section.

1.2 Intent

- .1 This Section describes the Contractor's responsibilities in the commissioning and handover of the process, electrical, and other systems to be installed as part of this Work.

1.3 Definitions

- .1 System: for the purpose of this Specification Section, a system shall be defined as the equipment, piping, controls, ancillary devices, electrical power, etc., which together perform a specific function at the facility.
- .2 Commissioning: for the purpose of this Specification Section, commissioning shall be defined as the successful operation of a system in accordance with its design requirements for a period of twenty-eight (28) Calendar Days, the last seven (7) of which shall be consecutive, unless otherwise specified.
- .3 Acceptance: for the purpose of this Specification Section, acceptance shall be defined as the formal turnover of a system to the City for his operation and maintenance. This shall occur after the successful end of commissioning of each system through a formal agreement between the Contract Administrator, the City, and the Contractor. Success of the commissioning period is determined by the Contract Administrator.

1.4 Commissioning Team

- .1 The Work of commissioning will be conducted by the Contractor, the Installation Contractor, the City, and the Contract Administrator.
- .2 The City's appointed staff shall represent process personnel and operating staff.
- .3 The Contractor shall provide appropriate personnel. These personnel shall be skilled workmen, able to expedite any minor repairs, adjustments, etc., as are required to complete commissioning with as few delays as possible.

1.5 Commissioning Plan

- .1 Develop a detailed methodology for the commissioning of the SRS at least ninety (90) Calendar Days prior to planned start of commissioning. The plan shall be drafted by the Contractor, Installation Contractor and Contract Administrator and include the following:

COMMISSIONING

- .1 Detailed schedule of events, including but not limited to the schedule for completion of testing of all component parts of the system in accordance with Section 01 43 33 prior to commissioning of a system.
 - .2 Method for introducing flow, disposing of SRS effluent, and disposing of any product/residuals generated during the commissioning process. The Contractor will take responsibility for the implementation of these measures.
 - .3 Sampling and analytical program for tests necessary to verify compliance with performance specifications.
 - .4 Planned attendance schedule for Manufacturer's Representatives.
 - .5 Contingency plans in the event of a process malfunction.
 - .6 Drawings and sketches as required to illustrate the planned sequence of events.
 - .7 List and details for all temporary equipment (pumps, etc.) required to facilitate Commissioning.
 - .8 List of all personnel who the Contractor plans for commissioning and handover with information indicating their qualifications for this Work.
- .2 The commissioning plan shall be reviewed prior to its implementation. The Contract Administrator shall be the final arbiter.

1.6 Equipment

- .1 All process, mechanical, electrical, control, and miscellaneous equipment related to a system shall be successfully installed and tested in accordance with Section 01 43 33 and any specific requirements noted in other Divisions. Form 103 shall be executed for each item.
- .2 As required in Section 01 33 00 – Submittal Procedures, O&M Manuals will be submitted and reviewed by the Contract Administrator.
- .3 Staff training sessions shall be completed.
- .4 Temporary equipment will be installed and tested as necessary to ensure that it functions reliably and consistently through the commissioning period.
- .5 Conduct sampling and analysis in accordance with the requirements of the latest version of "Standard Methods for the Examination of Water and Wastewater", AWWA/WEF.

1.7 Controls

- .1 All controls which are the responsibility of this Contractor shall be installed and tested prior to commissioning.
- .2 The Contract Administrator shall arrange for the simulation of the control sequences or shall allow for the operation of the system without the features included in the Work of others. Every effort shall be made to ensure that the commissioning period provides for the full and

COMMISSIONING

comprehensive operation of the equipment under all anticipated normal and adverse operating conditions.

1.8 Plant Utility Services

- .1 The City shall provide power, chemicals, and other ancillary services as necessary to operate the plant through the commissioning period. Provision of these services shall be limited to reasonable levels.

1.9 Manpower

- .1 Supply all staff required during commissioning as necessary to assist the City's staff in the operation of the plant.
- .2 Supply competent staff capable of maintaining, repairing, and adjusting the equipment and controls to achieve the intended design functions during the commissioning period.
- .3 Ensure equipment Manufacturer's Representatives are available as necessary to certify adjustments in equipment, to guide in setting correct operating limits, and to generally provide input as required for the appropriate operation of the equipment.

1.10 Operating Descriptions

- .1 Operating descriptions shall be prepared by the Contract Administrator for the plant systems. Other information outlining the operating requirements shall also be available from the Contract Administrator. The Contractor will review these descriptions and will make himself familiar with the requirements in order that he can undertake commissioning in an appropriate manner.

1.11 Design Parameters

- .1 Design parameters for the systems to be commissioned shall be as defined in the Specifications and/or the operating descriptions. The commissioning team will identify to the Contractor, which parameters shall be modified prior to commissioning and shall be responsible for any subsequent changes during the commissioning period.

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 Preparation

- .1 Each item of equipment included in the system to be commissioned shall be satisfactorily tested and Form 103 completed.
- .2 Piping, wiring, and other conduit systems shall be finished and tested.
- .3 Electrical connections shall be completed and inspected to the satisfaction of authorities having jurisdiction.
- .4 All other regulatory inspections shall be completed to the satisfaction of authorities having jurisdiction.

COMMISSIONING

- .5 Control systems shall be completed and the related control software debugged.

3.2 Sequence

- .1 The sequence of SRS commissioning shall be in a manner acceptable to the Contract Administrator.
- .2 For each system, the following sequence of events shall be followed:
 - .1 O&M Manuals shall be available as per the requirements of Section 01 33 00 at least fourteen (14) Calendar Days prior to the start of commissioning.
 - .2 The Contract Administrator will make operating descriptions available prior to testing.
 - .3 Initial operator training shall be undertaken two weeks prior to commissioning.
 - .4 Equipment performance tests shall be conducted successfully.
 - .5 Start and run system in manual mode.
 - .6 Turn separate items of equipment to automatic in a planned and logical manner. Ensure that the control system is operating the equipment in a manner which precludes damage of the equipment and which is consistent with the process operating requirements.
 - .7 Commence commissioning period of twenty-eight (28) Calendar Days. The equipment shall operate continuously and successfully through the last seven (7) Calendar Days of a commissioning period. Minor failures shall not void the commissioning period. A minor failure is defined as one which does not present a safety hazard, does not impact overall process functioning and can be temporarily overcome by the use of available standby equipment. The last seven (7) Calendar Days of the commissioning period shall be re-started if a critical failure occurs. A critical failure shall be deemed as one, which prohibits the process from functioning successfully for an eight hour period or one, which creates a safety hazard.

3.3 Commissioning

- .1 Wastewater will be introduced to the system in a manner which precludes the damage of any equipment or structures.
- .2 Twice during the commissioning period, plant component settings will be modified to ensure that the system is subjected to flows and loads as close to design conditions as possible. Where necessary to achieve this, flows to the area being commissioned will be augmented to exaggerate the naturally occurring flows and loads. Where it is necessary to modify settings outside the limits of this Contract area within the plant, coordinate the changes with plant staff.
- .3 Assist in the operation of the plant to achieve the process objectives.
- .4 All components and systems shall be operated in the automatic/manual and the remote/local modes as required to prove proper operation.

COMMISSIONING

- .5 Ensure all bypasses and backup provisions function satisfactorily.
- .6 All minor and major alarm conditions will be induced to ensure that the process reacts as intended, the applicable alarms are annunciated.
- .7 Samples of process flows, when necessary to prove performance, will be obtained and analyzed on a regular basis.

3.4 Completion

- .1 Commissioning of the Struvite Recovery System shall be considered complete when the system has operated in a stable manner, satisfying the design criteria for a period of twenty-eight (28) Calendar Days, the last seven (7) of which shall be continuous and consecutive, unless otherwise specified.
- .2 When the system has been commissioned satisfactorily, the system will be accepted for operation and routine maintenance by the City. On successful completion of Commissioning, Form 104 – Certificate of Satisfactory Process Performance attached to this Specification will be signed by the Contractor, Installation Contractor, Contract Administrator, and the City.

COMMISSIONING

**CERTIFICATE OF SATISFACTORY PROCESS PERFORMANCE
FORM 104**

We certify that the equipment listed below has been operated and tested as per the Specifications using water and that the equipment meets its performance testing criteria. The equipment is therefore classed as "conforming".

PROJECT: _____

SYSTEM DESCRIPTION: _____

TAG No (s): _____

**REFERENCE
SPECIFICATION (s):** _____

(Authorized Signing Representative of the Contractor (Supplier)) Date

(Authorized Signing Representative of the Installation Contractor) Date

(Authorized Signing Representative of the Contract Administrator) Date

(Authorized Signing Representative of the City of Winnipeg) Date

END OF SECTION

TRAINING

1. GENERAL

1.1 Description

- .1 This Section contains requirements for training the City staff, by persons retained by the Contractor specifically for the purpose, in the proper operation and maintenance of the equipment and systems installed under this Contract.
- .2 Unless specified otherwise, as a minimum, the Contractor is to allow at least four sessions of four hours of training for each item of equipment or system. Note the City operates a three shift system at the NEWPCC.
- .3 The intent is that the City should receive sufficient training on the equipment and systems that they are going to operate and maintain. The Contract Administrator shall have the authority to determine the duration and content of each training session required.

1.2 Quality Assurance

- .1 Where required by the equipment specifications, provide on-the-job training of the City staff. Training sessions will be conducted by qualified factory-trained representatives of the various equipment suppliers with a minimum of two years experience. Training includes instruction of City staff in equipment operation and preventive maintenance and instruction on mechanics, electricians, instrumentation, and communications technicians in normal maintenance up to major repair.
- .2 The trainers proposed by the Contractor shall be experienced in training plant operators and shall have relevant experience in similar Work.

1.3 Submittals

- .1 Submit the following information in accordance with Section 01 33 00. For phased testing and start-up activities, separate submittals can be prepared for equipment items or systems. The material will receive a "REVIEWED" or "REVIEWED AS MODIFIED" status by the Contract Administrator no later than four weeks prior to delivery of the training:
 - .1 Lesson plans and training manuals, handouts, visual aids, and other reference materials for each training session to be conducted by the Contractor's trainer(s).
 - .2 Date, time, and subject of each training session.
 - .3 Training schedule. Concurrent classes will not be allowed.

1.4 Location

- .1 Where specified, conduct training sessions for the City staff, operations and maintenance personnel, on the operation, care, and maintenance of the equipment and systems installed under this Contract. Training will take place at the Site of the Work and under the conditions specified in the following paragraphs.
- .2 Both field training and classroom training will take place at the Site. The Contract Administrator may direct the classroom training to take place at another suitable location.

TRAINING

1.5 Lesson Plans

- .1 Prepare formal written lesson plans for each training session and coordinate with the Contract Administrator. Lesson plans to contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan will contain a time allocation for each subject. Furnish 10 copies of necessary training manuals, handouts, visual aids, and reference materials at least two weeks prior to each training session.

1.6 Format and Content

- .1 Include time in the classroom and at the location of the equipment or system for each training session. As a minimum, cover the following topics for each item of equipment or system:
 - .1 Familiarization
 - .2 Safety
 - .3 Operation
 - .4 Troubleshooting
 - .5 Preventative maintenance
 - .6 Corrective maintenance
 - .7 Parts
 - .8 Local representatives

1.7 Video Recording

- .1 Advise all suppliers providing training sessions that the training material may be videotaped. The City may record each training session, and the material may be edited and supplemented with professionally produced graphics to provide a permanent record for the City's use.

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 General Requirements

- .1 Conduct training in conjunction with the equipment testing period. Schedule classes such that classroom sessions are interspersed with field instruction in logical sequence. Arrange to have the training conducted on consecutive Calendar Days, with no more than four hours of classes scheduled for any one shift.

TRAINING

- .2 Provide final operation and maintenance manuals, as defined in Section 01 33 00, for the specific equipment to the City at least four weeks prior to the start of any training. Video recording may take place concurrently with all training sessions.

3.2 Operator Classroom Training

- .1 As a minimum, classroom equipment training for operations personnel will include:
 - .1 The equipment's specific location in the plant and an operational overview. Use slides and drawings to aid discussion.
 - .2 Purpose and planned function of the equipment
 - .3 The operating theory of the equipment
 - .4 Start-up, shutdown, normal operation, and emergency operating procedures, including system integration and electrical interlocks, if any
 - .5 Safety items and procedures
 - .6 Routine maintenance procedures
 - .7 Operator detection, without test instruments, of specific equipment trouble symptoms
 - .8 Required equipment exercise procedures and intervals
 - .9 Routine disassembly and assembly of equipment if applicable for purposes such as operator inspection of equipment
 - .10 Exam

3.3 Operator Hands-On Training

- .1 As a minimum, hands-on equipment training for operations personnel will include:
 - .1 Identifying instrumentation: location of primary element; location of instrument readout; discuss purpose, basic operation, and information interpretation
 - .2 Discussing, demonstrating, and performing standard operating procedures and daily visual inspection of system operation.
 - .3 Discussing and performing the preventive maintenance activities
 - .4 Discussing and performing start-up and shutdown procedures
 - .5 Performing the required equipment exercise procedures
 - .6 Performing routine disassembly and assembly of equipment if applicable
 - .7 Identifying and reviewing safety items and performing safety procedures, if feasible

TRAINING

3.4 Maintenance Classroom Training

- .1 Classroom equipment training for the maintenance and repair personnel will include:
 - .1 Basic theory of operation
 - .2 Description and function of equipment
 - .3 Routine start-up and shutdown procedures
 - .4 Normal and major repair procedures
 - .5 Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.
 - .6 Routine and long-term calibration procedures
 - .7 Safety procedures
 - .8 Preventive maintenance and up to and including major repairs such as replacement of major equipment part(s) with the use of special tools.

3.5 Maintenance Hands-on Training

- .1 Hands-on equipment training for maintenance and repair personnel will include:
 - .1 Locating and identifying equipment components
 - .2 Reviewing the equipment function and theory of operation
 - .3 Reviewing normal repair procedures
 - .4 Performing routine start-up and shutdown procedures
 - .5 Reviewing and performing the safety procedures
 - .6 Performing City-approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems
 - .7 Reviewing and using Contractor's manuals in the hands-on training

3.6 Equipment and Systems for Training

- .1 Provide training during the equipment testing period.
- .2 Coordinate and finalize with the Contract Administrator on training schedules and duration of each training session.

3.7 Training Completion Forms

- .1 Training shall be conducted before the operation period as described in Form 103 (included in Section 01 43 33).

TRAINING

- .2 The Contract shall not be considered complete, for the purpose of issuing a Certificate of Substantial Performance, until the training has been provided and Form 103 has been completed and signed.
- .3 Form T1: To be completed for initial training. One form is to be used for each item of equipment for which training has been provided.
- .4 Form T2: To be completed for training during the warranty period. One form is to be used for each item of equipment for which training has been provided.
- .5 A sample of Forms T1 and T2 are attached to this Specification Section.

TRAINING

**CERTIFICATE OF SATISFACTORY TRAINING
FORM T1**

We certify that the initial training for the equipment listed below has been provided as per the Specifications.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

(Trainer)

Date

(Authorized Signing Representative of the City)

Date

TRAINING

**CERTIFICATE OF SATISFACTORY TRAINING
FORM T2**

We certify that the final training for the equipment listed below has been provided as per the Specifications.

PROJECT: _____

ITEM OF EQUIPMENT: _____

TAG NO: _____

**REFERENCE
SPECIFICATION:** _____

(Trainer)

Date

(Authorized Signing Representative of the City)

Date