



THE CITY OF WINNIPEG

REQUEST FOR PROPOSAL

RFP NO. 756-2013

**SUPPLY OF CONTROL SYSTEM AND MOTOR CONTROL EQUIPMENT FOR THE
SEWAGE TREATMENT PROGRAM**

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PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 SUPPLY OF CONTROL SYSTEM AND MOTOR CONTROL EQUIPMENT FOR THE SEWAGE TREATMENT PROGRAM

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 4:00 p.m. Winnipeg time, November 26, 2013.

B2.2 Proposals determined by the Manager of Materials to have been received later than the Submission Deadline will not be accepted and will be returned upon request.

B2.3 The Contract Administrator or the Manager of Materials may extend the Submission Deadline by issuing an addendum at any time prior to the time and date specified in B2.1.

B3. ENQUIRIES

B3.1 All enquiries shall be directed to the Contract Administrator identified in D6.1.

B3.2 If the Bidder finds errors, discrepancies or omissions in the Request for Proposal, or is unsure of the meaning or intent of any provision therein, the Bidder shall promptly notify the Contract Administrator of the error, discrepancy or omission at least five (5) Business Days prior to the Submission Deadline.

B3.3 If the Bidder is unsure of the meaning or intent of any provision therein, the Bidder should request clarification as to the meaning or intent prior to the Submission Deadline.

B3.4 Responses to enquiries which, in the sole judgment of the Contract Administrator, require a correction to or a clarification of the Request for Proposal will be provided by the Contract Administrator to all Bidders by issuing an addendum.

B3.5 Responses to enquiries which, in the sole judgment of the Contract Administrator, do not require a correction to or a clarification of the Request for Proposal will be provided by the Contract Administrator only to the Bidder who made the enquiry.

B3.6 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B3 unless that response or interpretation is provided by the Contract Administrator in writing.

B4. CONFIDENTIALITY

B4.1 Information provided to a Bidder by the City or acquired by a Bidder by way of further enquiries or through investigation is confidential. Such information shall not be used or disclosed in any way without the prior written authorization of the Contract Administrator. The use and disclosure of the confidential information shall not apply to information which:

- (a) was known to the Bidder before receipt hereof; or
- (b) becomes publicly known other than through the Bidder; or
- (c) is disclosed pursuant to the requirements of a governmental authority or judicial order.

B4.2 The Bidder shall not make any statement of fact or opinion regarding any aspect of the Bid Opportunity to the media or any member of the public without the prior written authorization of the Contract Administrator.

B5. ADDENDA

- B5.1 The Contract Administrator may, at any time prior to the Submission deadline, issue addenda correcting errors, discrepancies or omissions in the Request for Proposal, or clarifying the meaning or intent of any provision therein.
- B5.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.
- B5.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/bidopp.asp>
- B5.2.2 The Bidder is responsible for ensuring that he/she has received all addenda and is advised to check the Materials Management Division website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.
- B5.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 9 of Form A: Proposal. Failure to acknowledge receipt of an addendum may render a Proposal non-responsive.

B6. SUBSTITUTES

- B6.1 The Work is based on the materials, equipment, methods and products specified in the Request for Proposal.
- B6.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.
- B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least seven (7) Business Days prior to the Submission Deadline.
- B6.4 The Bidder shall ensure that any and all requests for approval of a substitute:
- (a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the material, equipment, method or product as either an approved equal or alternative;
 - (b) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;
 - (c) identify any anticipated cost or time savings that may be associated with the substitute;
 - (d) certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the Contract;
 - (e) certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the Contract.
- B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his/her sole discretion grant approval for the use of a substitute as an "approved equal" or as an "approved alternative", or may refuse to grant approval of the substitute.
- B6.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.

- B6.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he/she wishes to inform.
- B6.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.
- B6.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative may base his/her Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B24.
- B6.9 No later claim by the Contractor for an addition to the price(s) because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.
- B6.10 Notwithstanding B6.2 to B6.9 and in accordance with B7.7, deviations inconsistent with the Request for Proposal document shall be evaluated in accordance with B24.1(a).

B7. PROPOSAL SUBMISSION

- B7.1 The Proposal shall consist of the following components:
- (a) Form A: Proposal;
 - (b) Form B: Prices;
 - (c) Form N: Price Adjustment Proposal;
 - (d) Form P: Proposal Information;
- B7.2 The Proposal should consist of the following components:
- (a) Detailed Price Breakdown;
 - (b) Published Canadian Price List;
 - (c) Integration Capabilities;
 - (d) Technical Information.
- B7.3 Further to B7.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B6.
- B7.4 All components of the Proposal shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely, to constitute a responsive Proposal.
- B7.4.1 Bidders should submit one (1) unbound original (marked “original”) and six (6) bound copies.
- B7.4.2 Submit two CDs/DVDs of the complete proposal submission in searchable electronic PDF format.
- B7.4.3 In case of a discrepancy between the paper and electronic copies, the paper copy will take precedence.
- B7.5 The Proposal Submission shall be submitted enclosed and sealed in an envelope clearly marked with the RFP number and the Bidder’s name and address.
- B7.5.1 Samples or other components of the Proposal Submission which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the RFP number, the Bidder’s name and address, and an indication that the contents are part of the Bidder’s Proposal Submission.

- B7.6 Bidders are advised not to include any information/literature except as requested in accordance with B7.1.
- B7.7 Bidders are advised that inclusion of terms and conditions inconsistent with the Request for Proposal document, including the General Conditions, will be evaluated in accordance with B24.1(a).
- B7.8 Proposals submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.
- B7.9 Proposals shall be submitted to:
The City of Winnipeg
Corporate Finance Department
Materials Management Division
185 King Street, Main Floor
Winnipeg MB R3B 1J1

B8. PROPOSAL

- B8.1 The Bidder shall complete Form A: Proposal, making all required entries.
- B8.2 Paragraph 2 of Form A: Proposal shall be completed in accordance with the following requirements:
- (a) if the Bidder is a sole proprietor carrying on business in his/her own name, his/her name shall be inserted;
 - (b) if the Bidder is a partnership, the full name of the partnership shall be inserted;
 - (c) if the Bidder is a corporation, the full name of the corporation shall be inserted;
 - (d) if the Bidder is carrying on business under a name other than his/her own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.
- B8.2.1 If a Proposal is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B8.2.
- B8.3 In Paragraph 3 of Form A: Proposal, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Proposal.
- B8.4 Paragraph 11 of Form A: Proposal shall be signed in accordance with the following requirements:
- (a) if the Bidder is a sole proprietor carrying on business in his/her own name, it shall be signed by the Bidder;
 - (b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;
 - (c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers and the corporate seal, if the corporation has one, should be affixed;
 - (d) if the Bidder is carrying on business under a name other than his/her own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.
- B8.4.1 The name and official capacity of all individuals signing Form A: Proposal should be printed below such signatures.
- B8.5 If a Proposal is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Proposal and the Contract, when awarded, shall be both joint and several.

B9. PRICES

- B9.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.
- B9.1.1 Prices on Form B: Prices shall include:
- (a) duty;
 - (b) freight and cartage;
 - (c) Provincial and Federal taxes except the Goods and Services Tax (GST) and Manitoba Retail Sales Tax (MRST, also known as PST), which shall be extra where applicable and all charges governmental or otherwise paid;
 - (d) profit and all compensation which shall be due to the Contractor for the Work and all risks and contingencies connected therewith.
- B9.1.2 Prices on Form B: Prices shall not include Environmental Handling Charges (EHC) or fees, which shall be extra where applicable.
- B9.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Proposals.
- B9.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.
- B9.4 Where applicable to the Request for Proposal, payments for services to Non-Resident Bidders are subject to a Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).
- B9.5 The prices entered for Form B, Items 1 through 42 shall be the final offered selling price for the period from award to December 31, 2015. The prices shall include the discount factors indicated in Form B, Items 43 – 46.
- B9.6 The price entered for Form B, Item 15 shall be an annual price based upon the indicated quantity of programmable controller systems shown in Form B, Items 1-3. The actual payment will be prorated as per D18.3.
- B9.7 The price entered for Form B, Item 16 shall be an annual price based upon the indicated quantity of Programmable Controller Programming Software licences shown in Form B, Item 13. The actual payment will be prorated as per D18.4.
- B9.8 The price entered for Form B, Item 17 shall be an annual price based upon the indicated quantity of Process Simulator licences shown in Form B, Item 14. The actual payment will be prorated as per D18.5.
- B9.9 The price entered for Form B, Item 29 shall be an annual price based upon the indicated quantity of HMI, Web Server and Historian systems shown in Form B, Items 20-28. The actual payment will be prorated as per D18.6.
- B9.10 The price entered for Form B, Item 32 shall be an annual price based upon the indicated quantity of MCC systems shown in Form B, Item 32. The actual payment will be prorated as per D18.13.
- B9.11 The price entered for Form B, Item 36 shall be an annual price based upon the indicated quantity of VFDs shown in Form B, Items 33 and 34. The actual payment will be prorated as per D18.16.
- B9.12 The Bidder shall enter a standard discount off list price that shall apply to all programmable controller and related control system components in Form B, Item 43. The Bidder shall demonstrate that the relevant Form B prices are consistent with the indicated discount, as per B12.

- B9.13 The Bidder shall enter a standard discount off list price that shall apply to all HMI, Historian, and enterprise system components in Form B, Item 44. The Bidder shall demonstrate that the relevant Form B prices are consistent with the indicated discount, as per B12.
- B9.14 The Bidder shall enter a standard discount off list price that shall apply to all Motor Control Centres in Form B, Item 45. The Bidder shall demonstrate that the relevant Form B prices are consistent with the indicated discount, as per B12.
- B9.15 The Bidder shall enter a standard discount off list price that shall apply to all VFDs in Form B, Item 46. The Bidder shall demonstrate that the relevant Form B prices are consistent with the indicated discount, as per B12.
- B9.16 By submitting a proposal, the Bidder acknowledges and agrees that the pricing discount level provided in Form B is effectively provided for the manufacturer's entire control system, HMI, and motor control product offering.
- B9.16.1 In the event that a discrepancy between the Form B prices and the indicated discount off list price exists, the lower of the two prices shall be utilized.

B10. PRICE ADJUSTMENT PROPOSAL (FORM N)

- B10.1 The Bidder shall complete Form N: Price Adjustment Proposal, making all required entries.
- B10.2 Provision of a price adjustment proposal is a mandatory requirement.
- (a) Failure to provide a Price Adjustment Proposal will be evaluated in accordance with B24.1(a).
- B10.3 The Price Adjustment Proposal is applicable to Form B, Items 1 through 42 as well as the Bidder's complete control system and motor control equipment offering.
- B10.4 The price in effect shall be based upon the date that the purchase order is submitted to the Contractor.
- B10.5 Fixed Price Period
- B10.5.1 The prices indicated in Form B will be fixed through to December 31, 2015.
- B10.5.2 No escalation of prices will be permitted during this period for any cause.
- B10.6 Price adjustments will occur annually with the first adjustment taking effect on January 1, 2016.
- B10.7 Complete Form N to indicate the method, and details of price determination after the expiration of the fixed prices.
- B10.8 Fixed Escalation Rate
- B10.8.1 If the Price Adjustment is proposed to be based on a Fixed Escalation Rate, the following shall apply:
- (a) Contract prices for equipment and/or service will remain firm through the Fixed Price Period.
 - (b) Price adjustments will take effect annually after the Fixed Price Period expires, with the first adjustment on the first day after the Fixed Price Period.
 - (c) Price adjustments will be made in accordance with the percentage change indicated on Form N.
 - (d) Provision of a fixed escalation rate is mandatory through until December 31, 2020.
 - (e) For Motor Control Centre (MCC) equipment, the Bidder shall provide a means to provide constant list prices for engineered MCCs, upon which the proposed escalation rate will apply.

- (i) The means to provide constant list prices shall be acceptable to the Contract Administrator.
- (f) In the event that an escalation rate is not proposed for a given year:
 - (i) The actual escalation rate to be utilized will be negotiated with the City.
 - (ii) The Bid will be evaluated in accordance with B25.3.2(b).
- B10.8.2 Currency linkage may be proposed by the Bidder to allow adjustment of prices, such that the prices quoted are effectively linked to another currency. In the event that the Canadian dollar exchange rate relative to the other currency would drop, the effective price of the Goods would increase.
- B10.8.3 In the event that the Bidder indicates that the prices will be linked to a currency exchange rate on Form N, the following shall apply:
 - (a) The currency exchange rate indicated on the date of award shall be recorded and shall be deemed the effective exchange rate.
 - (b) Beginning on January 1, 2016 and every year thereafter, the currency exchange rate in effect thirty (30) Calendar Days prior shall be compared against the effective exchange rate. In the event that the current currency exchange rate is different by more than 5% from the effective exchange rate, the prices shall be adjusted accordingly and the current exchange rate shall be deemed the effective exchange rate.
 - (c) For example:
 - (i) If a linkage to the Can\$ / US\$ exchange rate is proposed and the Can\$ to US\$ exchange rate on the date of award is 0.95, this will be deemed the effective exchange rate. The prices in effect will be as per Form B and the indicated discount factors.
 - (ii) If on December 2, 2015 the Can\$ to US\$ exchange rate is 0.93, the change compared to the effective exchange rate (0.95) is less than 5%. Thus, no change to the pricing will be made on January 1, 2016 other than the other factors indicated in the Price Adjustment Proposal.
 - (iii) If on December 2, 2016 the Can\$ to US\$ exchange rate is 0.85, the change compared to the effective exchange rate (0.95) is 10.5%. Thus, in addition to fixed escalation rate indicated in the Price Adjustment Proposal, the prices on January 1, 2017 would be escalated by 10.5% due to the currency linkage.
 - (d) The currency exchange rate may either increase or lower the effective price in Canadian dollars.
 - (e) The currency exchange rate utilized shall be the nominal rate posted by the Bank of Canada.
- B10.8.4 The currency exchange rate to be utilized will be as indicated in Form N.
- B10.8.5 The Fixed Escalation Rate and Currency Exchange Rate adjustment shall apply to the Form B prices, as well as the manufacturer's complete control system and motor control equipment offering.
 - (a) The base prices for equipment not specifically listed in Form B will be based upon the list price submitted with the Bid and the discount factors indicated in Form B Items 43 to 46.
- B10.9 Published List Prices
 - B10.9.1 If the Price Adjustment is proposed to be based on Published List Prices, the following shall apply:
 - (a) The price will be based upon the Bidder's indicated discount off the manufacturer's Published Canadian Price List, as indicated in Form B.

- (b) The manufacturer shall employ a standard practice of utilizing constant discount percentages, and modifying the standard list price to account for the manufacturer's escalation.
- (c) The discount off list price indicated on Form B shall be a percentage of the list price that is subtracted from the list price to determine the actual price.
 - (i) Example: If a discount of 20% is indicated and the list price is \$1,000, the actual price would be \$800.
- (d) The prices indicated on Form B must be consistent with the Published Canadian Price List and the indicated discount on Form N. Significant discrepancies may, at the discretion of the City, result in the bid being deemed non-responsive.
- (e) The City reserves the right to use external sources to verify the validity of the Published Canadian Price List provided.
- (f) The escalation of prices on the standard price lists shall not exceed accepted market conditions. The City reserves the right to negotiate the prices or cancel the contract in the event that the price increments are excessive.
- (g) A new Published Canadian Price List shall be submitted to the Contract Administrator a minimum of 60 days prior to the new prices taking effect.
- (h) Except as indicated in B10.9(i), a new Published Canadian Price List will be accepted for price adjustment annually. The discount off list price indicated on Form N, shall not change. The price list must be in effect on January 1 of the year the prices take effect.
 - (i) The new prices will come into effect on January 1, 2016 and on January 1 annually thereafter.
- (i) For MCCs (Motor Control Centres), the list price may be calculated at the time of quotation / order and shall be consistent with the discount factor indicated in Form B.
 - (i) The list price may be a computer generated calculation that includes publically traded commodity indices and currency exchange rates, provided that all such price adjustments are auditable by the City of Winnipeg.
 - (ii) The discount factor indicated in Form B shall be applicable through the life of the Contract.
 - (iii) The list price calculation shall be applicable to all sales across Canada, and shall have no factors specific to the City of Winnipeg other than the discount factor indicated in Form B.

B10.10 Indexed Price Adjustment

- B10.10.1 If the Price Adjustment is proposed to be based on Indexed Price Adjustment, the following shall apply:
 - (a) Contract prices for equipment and/or service will remain firm through the Fixed Price Period.
 - (b) Price adjustments will take effect annually after the Fixed Price Period expires, with the first adjustment on January 1, 2016.
 - (c) Price adjustments will be made in accordance with the percentage change in the referenced index, as per Form N.
 - (d) The price adjustment rate will be determined by comparing the percentage difference between the index in effect at the award of the Contract and the latest index data available thirty (30) Calendar Days prior to the new prices taking effect. The percentage difference between the two index values will be the price adjustment rate from the original fixed prices.
- B10.10.2 The Indexed Price Adjustment shall apply to the Form B prices, as well as the manufacturer's complete control system and motor control equipment offering.

- (a) The base prices for equipment not specifically listed in Form B will be based upon the list price submitted with the Bid and the discount factors indicated in Form B Items 43 to 46.
- (b) For Motor Control Centre (MCC) equipment, the Bidder shall provide a means to provide constant list prices for engineered MCCs, upon which the proposed price adjustment will apply.
 - (i) The means to provide constant list prices shall be acceptable to the Contract Administrator.

B10.11 The Bidder's Price Adjustment proposal will be reflected in the calculation of the Evaluated Bid Price as per B25.

B10.12 Contract Extension Prices

B10.12.1 As indicated in D3, the City may negotiate a Contract extension with the Contractor. The prices for the Contract extension shall be consistent with the Contractor's Price Adjustment Proposal on Form N.

B11. PROPOSAL INFORMATION (FORM P)

B11.1 The Bidder shall complete Form P: Proposal Information, making all required entries. Where insufficient space is provided, attach additional pages as required.

B11.2 Form P will be utilized as reference information for the evaluation of the proposal.

B12. DETAILED PRICE BREAKDOWN

B12.1 Provide a detailed price breakdown, including a bill of materials, to detail the Bidder's proposal and demonstrate that the prices indicated in Form B are consistent with the discounts off list price indicated in Form B.

- (a) The purpose of this information is to:
 - (i) Provide the City a better understanding of the proposal.
 - (ii) Provide certainty that the manufacturer's products not specifically listed in Form B will be provided at the pricing level indicated.
- (b) Discrepancies between the detailed price breakdown and the indicated discount off list price will be evaluated in accordance with B25.6.

B12.2 The price breakdown shall at minimum be provided for the following items:

- (a) Form B, Item 1 – Programmable Controller System 1
- (b) Form B, Item 2 – Programmable Controller System 2
- (c) Form B, Item 3 – Programmable Controller System 3
- (d) Form B, Item 13 – Programmable Controller Programming Software
- (e) Form B, Item 19 – Programmable Controller Specialist Training
- (f) Form B, Item 20 – HMI Server System Software – Facility
- (g) Form B, Item 21 – HMI Operator Workstation Software / Licence
- (h) Form B, Item 22 – HMI Portable HMI Client Software / Licence
- (i) Form B, Item 23 – HMI Web Server System
- (j) Form B, Item 24 – HMI and Historian Programming Software
- (k) Form B, Item 25 – Historian Facility Server Software
- (l) Form B, Item 27 – Touchscreen HMI
- (m) Form B, Item 28 – Touchscreen HMI Programming Software
- (n) Form B, Item 30 – HMI Specialist Training

- (o) Form B, Item 31 – MCC System 1
- (p) Form B, Item 38 – Historian Central Archive Server Software (non-mandatory)
- (q) Form B, Item 39 – Version Management Software (non-mandatory)
- (r) Form B, Item 40 – Information Server Software (non-mandatory)
- (s) Form B, Item 41 – Metrics Server Software (non-mandatory)
- (t) Form B, Item 42 – Enterprise Database Integration Software (non-mandatory)

B12.3 Include the following in the Price Breakdown:

- (a) Quantity
- (b) Model / Part Number
- (c) Description
- (d) List Price
- (e) Discount
- (f) Total Price

B13. PUBLISHED CANADIAN PRICE LIST

B13.1 The Bidder shall provide a comprehensive manufacturer Published Canadian Price List.

B13.2 The scope of the Published Canadian Price List shall include:

- (a) All products proposed as part of the Bidder's proposal;
- (b) The manufacturer's entire control system product offering,
- (c) The manufacturer's entire HMI and Historian system product offering,
- (d) The manufacturer's entire MCC system product offering,
- (e) The manufacturer's entire motor control product offering,
- (f) All standard replacement and maintenance parts applicable to the products proposed.

B13.3 The Published Canadian Price List shall be a published standard list of prices, applicable to all sales by the manufacturer in Canada. Use of a price list that is specific to an individual or group of provinces, areas, industries, or customers is not acceptable. Provide evidence as requested to support the list prices submitted.

B14. INTEGRATION CAPABILITIES

B14.1 Proposals should include a document indicating the proposed capabilities regarding integration of:

- (a) Programmable Controllers;
- (b) HMIs;
- (c) Historians;
- (d) MCCs;
- (e) VFDs;
- (f) And instrumentation.

B14.1.1 Provide details regarding the integration of Programmable Controllers communicating with other Programmable Controllers.

B14.1.2 Provide details regarding the integration of 3rd Party Programmable Controllers.

B14.1.3 Provide details regarding the integration of Programmable Controller and HMI alarming systems.

- B14.1.4 Provide details regarding the integration of tagname databases between Programmable Controller, HMI, and Historian systems.
- B14.1.5 Provide details regarding the integration of the intelligent MCCs with the Programmable Controllers and HMI.
- B14.1.6 Provide details regarding the integration of the intelligent instrumentation with the Programmable Controllers and HMI.
- B14.1.7 Provide details regarding the integration capabilities with other enterprise systems.

B15. TECHNICAL INFORMATION

- B15.1 The Bidder shall provide the following technical information:
 - (a) Product datasheets for all the products proposed;
 - (b) Documents that demonstrate integration capabilities;
 - (c) Documents to support claims made in Form P.
 - (d) Other documents that represent the manufacturer capabilities, relating to the City's requirements.
- B15.2 The complete provision of the above information is not a mandatory bid requirement, but lack of information, or incomplete information, may affect the bid evaluation as per B24.

B16. QUALIFICATION

- B16.1 The Bidder shall:
 - (a) undertake to be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, Licensed or permitted by law to carry on business in Manitoba, or if the Bidder does not carry on business in Manitoba, in the jurisdiction where the Bidder does carry on business; and
 - (b) be financially capable of carrying out the terms of the Contract; and
 - (c) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract.
 - (d) The manufacturer will have a minimum of fifteen (15) years experience in the design and manufacture of control systems and motor control systems.
- B16.2 The Bidder and any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:
 - (a) be responsible and not be suspended, debarred or in default of any obligations to the City. A list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/debar.stm>
- B16.3 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:
 - (a) have successfully carried out work similar in nature, scope and value to the Work; and
 - (b) be fully capable of performing the Work required to be in strict accordance with the terms and provisions of the Contract; and
 - (c) have a written workplace safety and health program, if required, pursuant to The Workplace Safety and Health Act (Manitoba).
- B16.4 The Bidder shall submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B16.5 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

B17. OPENING OF PROPOSALS AND RELEASE OF INFORMATION

B17.1 Proposals will not be opened publicly.

B17.2 After award of Contract, the names of the Bidders and the Contract amount of the successful Bidder will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/>

B17.3 To the extent permitted, the City shall treat all Proposal as confidential, however the Bidder is advised that any information contained in any Proposal Submission may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

B17.4 Following the award of Contract, a Proponent will be provided with information related to the evaluation of its submission upon written request to the Project Manager.

B18. IRREVOCABLE OFFER

B18.1 The Proposal(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 10 of Form A: Proposal.

B18.2 The acceptance by the City of any Proposal shall not release the Proposals of the other responsive Bidders and these Bidders shall be bound by their offers on such Work for the time period specified in Paragraph 10 of Form A: Proposal.

B19. WITHDRAWAL OF OFFERS

B19.1 A Bidder may withdraw his/her Proposal without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

B19.1.1 Notwithstanding C21, the time and date of receipt of any notice withdrawing a Proposal shall be the time and date of receipt as determined by the Manager of Materials.

B19.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Proposal or the Bidder's authorized representatives named in Paragraph 11 of Form A: Proposal, and only such person, has authority to give notice of withdrawal.

B19.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials will:

- (a) retain the Proposal until after the Submission Deadline has elapsed;
- (b) open the Proposal to identify the contact person named in Paragraph 3 of Form A: Proposal and the Bidder's authorized representatives named in Paragraph 11 of Form A: Proposal; and
- (c) if the notice has been given by any one of the persons specified in B19.1.3(b), declare the Proposal withdrawn.

B19.2 A Bidder who withdraws his/her Proposal after the Submission Deadline but before his/her offer has been released or has lapsed as provided for in B18.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law.

B20. INTERVIEWS

B20.1 The Contract Administrator may, in his/her sole discretion, interview Bidders during the evaluation process.

B21. SYSTEM DEMONSTRATION

B21.1 Purpose

(a) The purpose of the System Demonstration is to allow for an evaluation of the manufacturer's product capabilities and the level of integration between the products.

B21.2 Bidders who proceed to Phase 2 of the evaluation, as per B24, will be requested to provide a System Demonstration.

(a) System Demonstrations will not be accepted from Bidders not proceeding to Phase 2 of the evaluation.

(b) The City reserves the right to cancel the requirement for a System Demonstration in accordance with B24.4.2(f).

B21.3 Location

(a) The System Demonstration will be performed in a facility provided by the Bidder.

(b) The location of the System Demonstration shall be within North America.

B21.4 Schedule

(a) The Bidder is required to perform the System Demonstration within forty (40) Calendar Days of notification, unless extended at the City's request.

(b) The Bidder shall schedule a date with the Contract Administrator within ten (10) Calendar Days of notification.

(c) The time allocated for each Bidder's System Demonstration is eight hours. The System Demonstration shall not exceed one day.

B21.5 Costs

(a) All costs for providing the System Demonstration shall be borne by the Bidder.

(b) All travel costs for the City's evaluation team will be covered by the City.

B21.6 Allow for up to five (5) members of the City's evaluation team.

B21.7 The technical requirements for the System Demonstration are indicated in E5.

B21.8 Prior to initiating the System Demonstration, submit to the Contract Administrator:

(a) A detailed description of the demonstration equipment to be utilized, including all hardware and software components.

(b) A proposed schedule for the System Demonstration.

B21.9 All equipment, components, and software included in the System Demonstration, is deemed to be included in the Bidder's Proposal, unless identified as per B21.9.1.

B21.9.1 Any equipment, components, or software included in the System Demonstration that is not included in the Bidder's Proposal shall be clearly identified as an exclusion in a written submission to the Contract Administrator, prior to initiating the System Demonstration.

B21.10 The System Demonstration will be evaluated in accordance with B24.

(a) Bidders are encouraged to avoid "sales glamour presentations" and focus on the technical capabilities and integration capabilities of the products proposed.

B22. NEGOTIATIONS

- B22.1 The City reserves the right to negotiate details of the Contract with any Bidder. Bidders are advised to present their best offer, not a starting point for negotiations in their Proposal Submission.
- B22.2 The City may negotiate with the Bidders submitting, in the City's opinion, the most advantageous Proposals. The City may enter into negotiations with one or more Bidders without being obligated to offer the same opportunity to any other Bidders. Negotiations may be concurrent and will involve each Bidder individually. The City shall incur no liability to any Bidder as a result of such negotiations.
- B22.2.1 Negotiations may be initiated prior to, or after, the System Demonstration.
- B22.3 If, in the course of negotiations pursuant to B22.2 or otherwise, the Bidder amends or modifies a Proposal after the Submission Deadline, the City may consider the amended Proposal as an alternative to the Proposal already submitted without releasing the Bidder from the Proposal as originally submitted.
- B22.4 Upon completion of negotiations and receipt of any best and final offer(s), the City will evaluate the Proposals received in accordance with the evaluation criteria set out in the RFP. If an award is made, it will be made to the Proponent determined to have the most advantageous Proposal, as originally submitted or as revised in accordance with B22.

B23. NON-CONFORMING SUBMISSIONS

- B23.1 Notwithstanding B7, with the exception of B2.2, if a Proponent's Submission is not strictly in accordance with any provision of this RFP, the City may, at its option:
- (a) waive the non-conformance if, in the City's opinion, the non-conformance is immaterial; or
 - (b) reject the Submission as non-responsive if, in the City's opinion, the non-conformance is material.
- B23.2 If the non-conformance is an omission, the City may, at its discretion, give the Proponent up to five (5) Business Days to supply the omitted material.

B24. EVALUATION OF PROPOSALS

B24.1 Award of the Contract shall be based on the following evaluation criteria:

- (a) compliance by the Bidder with the requirements of the Request for Proposal, or acceptable deviation therefrom (pass/fail);
- (b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B10 (pass/fail);
- (c) Evaluated Bid Price, calculated as per B25 40 pts
- (d) Product Lifecycle Guarantee 2 pts
- (e) Programmable Controllers Technical Features and Capabilities 10 pts
- (f) Process Simulator 2 pts
- (g) HMI System Technical Features and Capabilities 7 pts
- (h) Historian System Technical Features and Capabilities 7 pts
- (i) MCC System Technical Features and Capabilities 10 pts
- (j) Variable Frequency Drives Features and Capabilities 5 pts
- (k) Non-Mandatory Software Systems 5 pts
- (l) Integration Capabilities 10 pts
- (m) Service and Support 2 pts
- (n) Phase 2 Evaluation (System Demonstration) 20 pts
- (o) economic analysis of any approved alternative pursuant to B6;

B24.2 Further to B24.1(a), the Award Authority may reject a Proposal as being non-responsive if the Proposal Submission is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Proposal, or waive technical requirements or minor informalities or irregularities if the interests of the City so require.

B24.3 Further to B24.1(b), the Award Authority shall reject any Proposal submitted by a Bidder who does not demonstrate, in his/her Proposal, in other information required to be submitted, during interviews or in the course of reference checks, that he/she is responsible and qualified.

B24.4 The evaluation of proposals shall be in two phases:

B24.4.1 Phase 1 Evaluation

- (a) The Phase 1 evaluation will be performed subsequent to the Bid Submission Deadline and will consist of the components identified in B24.1, with the exception of the Phase 2 Evaluation (System Demonstration).
- (b) Based upon the Phase 1 evaluation, the most advantageous offers will be selected to proceed to Phase 2 of the evaluation.
 - (i) The City reserves the right to select all Bidders to proceed to the Phase 2 evaluation if this is deemed to be in the best interests of the City.
 - (ii) The City reserves the right to cancel the Phase 2 evaluation, as per B24.4.2(f).

B24.4.2 Phase 2 Evaluation

- (a) Bidders selected to proceed to the Phase 2 evaluation will be notified and requested to perform a System Demonstration as per B21.
- (b) The Phase 2 evaluation will be performed based on the System Demonstration of each Bidder.
- (c) The scores assigned during the Phase 1 evaluation may be re-assessed and re-scored during the Phase 2 evaluation, based upon new information or a better understanding of the Bidders products or proposal.
- (d) The Phase 2 evaluation will be as per B24.15.

- (e) The total score for the Phase 2 evaluation will be as per B24.1.
- (f) The City reserves the right to cancel the Phase 2 evaluation, for any reason.
- (g) In the event that the Phase 2 evaluation is cancelled, the proposal will be evaluated without the Phase 2 evaluation component identified in B24.1(n).

B24.5 Further to B24.1(d), the Product Lifecycle Guarantee will be evaluated based upon Form P.

B24.6 Further to B24.1(e), the Programmable Controllers Technical Features and Capabilities will be evaluated utilizing the following as sources:

- (a) Form P;
- (b) Integration Capabilities provided as per B14.
- (c) Technical Information provided as per B15.
- (d) Other information submitted with the proposal.
- (e) Technical Information relating to the products proposed available on the manufacturer's web site.

B24.7 Further to B24.1(f), the Process Simulator Features and Capabilities will be evaluated utilizing the following as sources:

- (a) Form P;
- (b) Integration Capabilities provided as per B14.
- (c) Technical Information provided as per B15.
- (d) Other information submitted with the proposal.
- (e) Technical Information relating to the products proposed available on the manufacturer's web site.

B24.8 Further to B24.1(g), the HMI System Technical Features and Capabilities will be evaluated utilizing the following as sources:

- (a) Form P;
- (b) Integration Capabilities provided as per B14.
- (c) Technical Information provided as per B15.
- (d) Other information submitted with the proposal.
- (e) Technical Information relating to the products proposed available on the manufacturer's web site.

B24.9 Further to B24.1(h), The Historian System Technical Features and Capabilities will be evaluated utilizing the following as sources:

- (a) Form P;
- (b) Integration Capabilities provided as per B14.
- (c) Technical Information provided as per B15.
- (d) Other information submitted with the proposal.
- (e) Technical Information relating to the products proposed available on the manufacturer's web site.

B24.10 Further to B24.1(i), the MCC System Technical Features and Capabilities will be evaluated utilizing the following as sources:

- (a) Form P;
- (b) Integration Capabilities provided as per B14.
- (c) Technical Information provided as per B15.
- (d) Other information submitted with the proposal.

- (e) Technical Information relating to the products proposed available on the manufacturer's web site.
- B24.11 Further to B24.1(j), the Variable Frequency Drives Features and Capabilities will be evaluated utilizing the following as sources:
- (a) Form P;
 - (b) Integration Capabilities provided as per B14.
 - (c) Technical Information provided as per B15.
 - (d) Other information submitted with the proposal.
 - (e) Technical Information relating to the products proposed available on the manufacturer's web site.
- B24.12 Further to B24.1(k), the Non-Mandatory Software Systems will be evaluated considering the potential benefit to the City. This will be evaluated utilizing the following as sources:
- (a) Form P;
 - (b) Integration Capabilities provided as per B14.
 - (c) Technical Information provided as per B15.
 - (d) Other information submitted with the proposal.
 - (e) Technical Information relating to the products proposed available on the manufacturer's web site.
- B24.13 Further to B24.1(l), the Integration Capabilities will be evaluated considering the overall benefits in terms of reduced integration time, costs, and maintenance efforts.
- This will be evaluated utilizing the following as sources:
- (a) Form P;
 - (b) Integration Capabilities provided as per B14.
 - (c) Technical Information provided as per B15.
 - (d) Other information submitted with the proposal.
 - (e) Technical Information relating to the products proposed available on the manufacturer's web site.
- B24.14 Further to B24.1(m) the Service / Support will be evaluated based upon the proposal information submitted in Form P, considering the service and support requirements of the City.
- B24.15 Further to B24.1(n), the Phase 2 Evaluation will be evaluated based upon the System Demonstration, considering the overall capability of the manufacturer and products demonstrated to meet the needs of the City.
- (a) Specific evaluation items include, but are not limited to:
 - (i) Ease of maintenance for all system components.
 - (ii) Ease of configuration / programming.
 - (iii) Integration capabilities within the various system components.
 - (iv) Integration capabilities with instrumentation.
 - (v) Tolerance to abnormal system situations.
 - (vi) Features provided in addition to the specified requirements.
 - (b) In accordance with B24.4.2, the System Demonstration will only be evaluated in Phase 2, for the Bidders selected to proceed to Phase 2.
 - (c) A score of zero will be applied to the Phase 2 Evaluation component for all Bidders' proposals during the Phase 1 evaluation.
- B24.16 This Contract will be awarded as a whole.

B24.17 If, in the sole opinion of the City, a Proposal does not achieve a pass rating for B24.1(a) and B24.1(b), the Proposal will be determined to be non-responsive and will not be further evaluated.

B25. EVALUATED BID PRICE

B25.1 The subtotal bid price will be calculated based upon Form B as the sum of the estimated quantities multiplied by the unit prices for Items 1 through 42.

B25.2 Further to B24.1(c), the Evaluated Bid Price will be calculated as the sum of the Estimated Cost Per Year multiplied by the estimated total escalation for the year.

(a) The Estimated Cost Per Year will be calculated as follows:

- (i) Year 0 (2014): 0% of the subtotal bid price;
- (ii) Year 1 (2015): 2% of the subtotal bid price;
- (iii) Year 2 (2016): 15% of the subtotal bid price, plus escalation;
- (iv) Year 3 (2017): 15% of the subtotal bid price, plus escalation;
- (v) Year 4 (2018): 12% of the subtotal bid price, plus escalation;
- (vi) Year 5 (2019): 15% of the subtotal bid price, plus escalation, plus currency exchange rate factor indicated in B25.3.1;
- (vii) Year 6 (2020): 15% of the subtotal bid price, plus escalation;
- (viii) Year 7 (2021): 15% of the subtotal bid price, plus escalation;
- (ix) Year 8 (2022): 7% of the subtotal bid price, plus escalation;
- (x) Year 9 (2023): 2% of the subtotal bid price, plus escalation;
- (xi) Year 10(2024): 2% of the subtotal bid price, plus escalation.

B25.3 The estimated total escalation for each year will be based upon the Bidder's Price Adjustment Proposal in Form N.

B25.3.1 If the Price Adjustment includes a linkage to the Currency Exchange Rate, an additional escalation rate of 2.5% shall be added to the escalation for January 1, 2019. Otherwise, no additional escalation factor shall apply.

B25.3.2 If the Price Adjustment is proposed to be based on a Fixed Escalation Rate, the following shall apply:

- (a) The calculation of the Evaluated Bid Price will utilize the indicated escalation values indicated on Form N.
- (b) In the event that a percentage price increase is not proposed after December 31, 2020, the annual escalation assumed for the purpose of bid evaluation will be the maximum price increase for the respective year from all other responsive bids, or 7%, whichever is greater.

B25.3.3 If the Price Adjustment is proposed to be based on Published List Prices, the following shall apply:

- (a) An annual escalation value of 4.5% will be assumed for the calculation of the Evaluated Bid Price, provided that a Published Canadian Price List is found to be consistent with Form B and the discount proposed in Form B.
- (b) In the event that the standard list prices are not deemed sufficiently consistent with Form B and the discount proposed in Form B, an annual escalation value of 5.0% will be assumed.
- (c) In the event that the standard list price has, in the opinion of the Contract Administrators, major inconsistencies with Form B and the discount proposed in Form B, the Contract Administrator may deem the bid non-responsive.

B25.3.4 If the Price Adjustment is proposed to be based on Indexed Price Adjustment, the following shall apply:

- (a) An annual escalation rate of 3.0% or the average change of the last five years of the index, whichever is greater, will be assumed for the calculation of the Evaluated Bid Price.

B25.4 In the event that a product is not proposed for Form B Items 1 through 37, the City may:

- (a) Deem the bid nonresponsive in accordance with B24.2; or
- (b) Utilize for the purpose of Bid Evaluation, the average price for the item of the other responsive Bids; or
- (c) In the event that the product specified is adequately addressed by other products in the Bidder's proposal, a price of zero will be utilized for the corresponding line item.

B25.5 The following items are not mandatory. In the event that a price is not provided, the item cost for the corresponding item will be calculated as follows, for the purpose of calculating the Evaluated Bid Price:

B25.5.1 Items 38 - 42:

- (a) If not proposed, the item unit price will be calculated as follows:
 - (i) The average price of the item of the other Bids that proposed a price for the corresponding item.
- (b) If the item is not proposed, as the required features are deemed to be sufficiently included in the base offering:
 - (i) A price of 0 shall be utilized for the corresponding line item.

B25.6 In the event that the discount off list price indicated in Form B Items 43, 44, 45, and 46 are not consistent with the other prices in Form B, the City may deem the bid nonresponsive in accordance with B24.2.

B26. AWARD OF CONTRACT

B26.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B26.2 The City will have no obligation to award a Contract to a Bidder, even though one or all of the Bidders are determined to be responsible and qualified, and the Proposals are determined to be responsive.

B26.2.1 Without limiting the generality of B26.2, the City will have no obligation to award a Contract where:

- (a) the prices exceed the available City funds for the Work;
- (b) the prices are materially in excess of the prices received for similar work in the past;
- (c) the prices are materially in excess of the City's cost to perform the Work, or a significant portion thereof, with its own forces;
- (d) only one Proposal is received; or
- (e) in the judgment of the Award Authority, the interests of the City would best be served by not awarding a Contract.

B26.3 Where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the most advantageous offer, in accordance with B24.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

- C0.1 The *General Conditions for the Supply of Goods* (Revision 2008 05 26) are applicable to the Work of the Contract.
- C0.1.1 The *General Conditions for the Supply of Goods* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/gen_cond.stm
- C0.2 A reference in the Request for Proposal to a section, clause or subclause with the prefix “**C**” designates a section, clause or subclause in the *General Conditions for Supply of Goods*.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

D1.1 In addition to the *General Conditions for the Supply of Goods*, these Supplemental Conditions are applicable to the Work of the Contract.

D2. INTENT

D2.1 The intent of this Request for Proposal is to select a control system and motor control equipment manufacturer for the City's Sewage Treatment Program and set the conditions for supply.

D2.2 The quantities indicated in Form B are the current best estimate of the equipment to be procured, however the City's upgrade and expansion plans are still in development, and thus the actual quantities purchased are subject to change.

D2.3 The control system and motor control equipment shall be produced by a single manufacturer, to assure seamless integration.

D2.4 It is intended that the manufacturer selected by this RFP process may be considered the standard for control system and motor control equipment to be utilized for the City of Winnipeg wastewater treatment facilities.

D2.4.1 The City may procure control system and motor control equipment, not specifically identified under this Request For Proposal, via this Contract without initiating a separate Bid Opportunity process.

D2.5 The Goods to be purchased under this contract are intended to be utilized at the SEWPCC, NEWPCC, and WEWPCC facilities.

D2.6 The City of Winnipeg reserves the right to procure equipment under this Contract for other City of Winnipeg facilities, without initiating a separate Bid Opportunity process.

D3. SCOPE OF WORK

D3.1 The Work to be done under the Contract shall consist of supply and delivery of control system and motor control equipment for the period from contract award until June 30, 2019 with the option of four (4) five (5) year extensions.

D3.1.1 The City may extend the term of this contract upon the first expiry, dated June 30, 2019, by providing written notice to the Contractor within one hundred twenty (120) Calendar Days prior to the expiry date of the Contract.

(a) If exercised by the City, the first five (5) year extension of the Contract is mandatory for the Contractor.

(b) The City shall incur no liability to the Contractor if the option is not exercised.

D3.1.2 All extensions subsequent Contract extensions after June 30, 2024 shall be mutually agreed upon between the City and the Contractor, based upon negotiations.

(a) The City may negotiate the extension option with the Contractor within one hundred eighty (180) Calendar Days prior to the expiry date of the Contract. The City shall incur no liability to the Contractor as a result of such negotiations.

(b) Changes resulting from such negotiations shall become effective on July 1 of the respective year. Changes to the Contract shall not be implemented by the Contractor without written approval by the Contract Administrator.

- D3.1.3 The prices for Contract extensions shall be consistent with the Price Proposal indicated in Form N and B10.
- D3.2 The Work shall be done on an "as required" basis during the term of the Contract.
- D3.2.1 The type and quantity of Work to be performed under this Contract shall be as authorized from time to time by the Contract Administrator and/or Installation Contractors by a purchase order.
- D3.2.2 Subject to C7, the City shall have no obligation under the Contract to purchase any quantity of any item in excess of its actual requirements.

D4. PROCUREMENT VIA INSTALLATION CONTRACTORS

- D4.1 Procurement of Goods under this Contract may be directly by the City, or indirectly via an Installation Contractor engaged by the City.
- (a) It is expected that most of the Goods purchased under the Contract will be via Installation Contractors engaged by the City.
- D4.2 The Contractor shall allow Installation Contractors to procure equipment on behalf of the City, based upon the pricing, technical specifications and delivery requirements this Contract.
- D4.3 The pricing provided to Installation Contractors shall be as per the Contract. No additional surcharges shall be applied.
- D4.4 Payment for all Goods procured via an Installation Contractor shall be the responsibility of the Installation Contractor, as per D17.
- D4.5 The City shall incur no liability to the Contractor for Goods procured via an Installation Contractor, other than that required by Provincial Regulations (Builders' Liens Act).
- D4.6 The Contractor shall not impose any restrictions or conditions on the Installation Contractors in relation to this Contract.
- D4.7 Failure to deliver Goods to the Installation Contractor may be determined to be an event of default.
- D4.8 Upon request by the City or a potential Installation Contractor for installation work on behalf of the City, the Contractor shall provide an itemized quotation for the Goods, consistent with the terms of the Contract.
- D4.9 Where the City issues a Bid Opportunity, which includes the supply and installation of Goods related to this Contract, the Contractor shall review the Bid Opportunity package to identify and confirm the scope of Goods required under the Bid Opportunity. The quotation of Goods shall be comprehensive to the requirements of the Bid Opportunity.
- D4.10 The Contractor shall provide an equal quotation to all potential Installation Contractors, consistent with the terms of the Contract.
- D4.10.1 The Contractor shall supply a copy of the quotation made to potential Installation Contractors to the Contract Administrator.
- D4.11 Invoices to Installation Contractors must clearly indicate, as a minimum:
- (a) the City's Bid Opportunity Number shall be indicated;
- (b) date of delivery;
- (c) delivery address;
- (d) type and quantity of Goods delivered;
- (e) the amount payable with GST, MRST, and any applicable environmental handling charges/fees identified and shown as separate amounts; and

- (f) the Contractor's GST registration number.
- (g) The Installation Contractor's name.

D4.12 The Goods delivered and associated amounts payable must be clearly itemized and priced in a manner to allow the City to verify that the proposed pricing and terms of the Contract are being adhered to.

D5. DEFINITIONS

D5.1 When used in this Request for Proposal:

- (a) "AI" means Analog Input.
- (b) "AO" means Analog Output.
- (c) "CAD" means Computer Aided Design.
- (d) "CPU" means Central Processing Unit.
- (e) "DCS" means Distributed Control System.
- (f) "DI" means Digital/Discrete Input.
- (g) "DO" means Digital/Discrete Output.
- (h) "FAT" means Factory Acceptance Test.
- (i) "FVNR" means Full Voltage Non-Reversing.
- (j) "HMI" means Human Machine Interface.
- (k) "I/O" means Input/Output.
- (l) "LAN" means Local Area Network.
- (m) "MCC" means Motor Control Centre
- (n) "NC" means Normally Closed.
- (o) "NEWPCC" means North End Water Pollution Control Centre.
- (p) "NO" means Normally Open.
- (q) "OPC" means OLE for Process Control.
- (r) "OS" means Operating System.
- (s) "O&M" means Operation and Maintenance.
- (t) "OWS" means Operator Workstation.
- (u) "PAC" means Programmable Automation Controller and shall be deemed a synonym of a Programmable Logic Controller.
- (v) "PCI" means Peripheral Control Interface.
- (w) "PCU" means Process Control Unit.
- (x) "PID" means Proportional, Integral and Derivative.
- (y) "PLC" means Programmable Logic Controller and shall be deemed a synonym of a Programmable Automation Controller.
- (z) "Programmable Controller" means an industrial-grade modular automation control system that is configurable to meet the requirements of specific automation control applications. A Programmable Logic Controller (PLC) or a Programmable Automation Control (PAC) are deemed to be equivalent.
- (aa) "PWS" means Programming Workstation
- (bb) "RAM" means Random Access Memory.
- (cc) "ROM" means Read Only Memory.
- (dd) "SEWPCC" means South End Water Pollution Control Centre.

- (ee) "TU" means Termination Unit.
- (ff) "UI" means Universal Input.
- (gg) "USB" means Universal Serial Bus.
- (hh) "VFD" means Variable Frequency Drive
- (ii) "WEWPCC" means West End Water Pollution Control Centre.

D5.2 Notwithstanding C1.1, when used in this Request for Proposal:

- (a) "**Installation Contractor**" means the person undertaking construction or implementation work under a separate contract with the City, who will utilize the pricing, terms, and conditions of this Contract to procure equipment for performing the work under the separate contract. The Installation Contractor may be a subcontractor to a contractor engaged by the City.

D6. CONTRACT ADMINISTRATOR

D6.1 The Contract Administrator is SNC-Lavalin Inc., represented by:

Curtis Reimer
Project Manager / Lead Automation Engineer
SNC-Lavalin Inc.
148 Nature Park Way, Winnipeg, MB, R3P 0X7
curtis.reimer@snclavalin.com

Telephone No. (204) 786-8080
Facsimile No. (204) 786-7934

D6.2 Bids Submissions must be submitted to the address in B7.9.

D7. RETURN OF GOODS

D7.1 Further to C9.8 to C9.13, Goods incorrectly supplied as a result of the Contractors error shall be returned at no cost to the City.

D7.2 Further to C9.8 to C9.13, Goods incorrectly supplied as a result of the City's error will be returned at the City's cost.

D7.3 Further to C9.8 to C9.13, the Contractor will be responsible for costs and any associated equipment manufacturer correspondence for any and all equipment delivered in an unusable state.

D7.4 Where restocking fees apply, they shall not exceed 10%.

D8. CHANGES IN THE WORK

D8.1 Further to C7, the City anticipates that during the term of the Contract there will be changes including but not limited to:

- (a) Products line / model availability;
- (b) Products required to meet specific applications.

D8.2 Changes shall be addressed in accordance with C7 of the General Conditions.

D8.3 The Contractor shall advise the City of planned obsolescence of a product or product line a minimum of one year prior to obsolescence.

- (a) The Contractor shall provide detailed technical literature on the proposed replacement. The Contract Administrator will determine the technical acceptability of the proposed replacement product.

- D8.4 Where the Contractor is unable to provide a replacement product to meet changes in the City's requirements, the City shall have the right to remove the product from the Contract.
- D8.5 The price of the proposed replacement product must have pricing that is comparable and consistent with the pricing originally proposed in the Contractor's submission. The Contractor shall clearly justify any price changes for the replacement product. The City reserves the right to negotiate the pricing for replacement products.
- D8.6 Where the price of the replacement product is deemed by the City to not be comparable to the original product proposed, the City shall have the right to remove the product from the Contract.
- D8.7 Where the proposed replacement product(s) and/or pricing no longer meets the overall intent of this Request for Proposal, the City reserves the right to cancel the complete Contract or the applicable portion.

D9. NOTICES

- D9.1 Notwithstanding C21.3 all notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following facsimile number:
- The City of Winnipeg
Chief Financial Officer
Facsimile No.: 204 949-1174

D10. OWNERSHIP OF INFORMATION, CONFIDENTIALITY AND NON DISCLOSURE

- D10.1 The Contract, all deliverables produced or developed, and information provided to or acquired by the Contractor are the property of the City and shall not be appropriated for the Contractor's own use, or for the use of any third party.
- D10.2 The Contractor shall not make any public announcements or press releases regarding the Contract, without the prior written authorization of the Contract Administrator.
- D10.3 The following shall be confidential and shall not be disclosed by the Contractor to the media or any member of the public without the prior written authorization of the Contract Administrator;
- (a) information provided to the Contractor by the City or acquired by the Contractor during the course of the Work;
 - (b) the Contract, all deliverables produced or developed; and
 - (c) any statement of fact or opinion regarding any aspect of the Contract.
- D10.4 A Contractor who violates any provision of D10 may be determined to be in breach of Contract.

D11. FACILITY STANDARD

- D11.1 The control system and MCC manufacturer selected through this RFP process may be utilized as a facility standard for the wastewater treatment facilities.

SUBMISSIONS

D12. AUTHORITY TO CARRY ON BUSINESS

- D12.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, Licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

SCHEDULE OF WORK

D13. COMMENCEMENT

- D13.1 The Contractor shall not commence any Work until he/she is in receipt of a notice of award from the City authorizing the commencement of the Work.
- D13.2 The Contractor shall not commence any Work until:
- (a) the Contract Administrator has confirmed receipt and approval of:
 - (i) evidence of authority to carry on business specified in D12;
 - (ii) where applicable, evidence of the workers compensation coverage specified in C6.16;
 - (b) the Contractor has attended a meeting with the Contract Administrator, or the Contract Administrator has waived the requirement for a meeting.

D14. DELIVERY

- D14.1 Control system (Programmable Controller and HMI) Goods shall be delivered within thirty (30) Calendar days, f.o.b. destination, freight prepaid to the destination indicated on the purchase order.
- D14.2 Individual Motor control equipment (such as VFDs, etc.) shall be delivered within thirty (30) Calendar days, f.o.b. destination, freight prepaid to the destination indicated on the purchase order.
- D14.3 Motor Control Centers shall be delivered within one hundred twenty (120) Calendar days, f.o.b. destination, freight prepaid to the destination indicated on the purchase order.
- (a) Allow a total of fifteen (15) Calendar days for the review of the initial and final Shop drawings. If more than two submissions of Shop drawings are required, no additional allowance for shop drawing review will be made.
- D14.4 All destinations may be assumed to be within the limits of the City of Winnipeg.
- D14.5 Notwithstanding D14.1, D14.2 and D14.3, all Goods shall be delivered within the maximum timeframes indicated on Form P, or as per D14.1, D14.2 and D14.3, whichever is less.
- D14.6 The average of all deliveries within a given annual period determined by the Contract Administrator shall be within the average timeframe indicated on Form P.
- D14.7 The Contractor shall off-load Goods as directed at the delivery location.
- D14.8 Where Goods are ordered directly by the City, the following shall apply:
- D14.8.1 The Contractor shall confirm each delivery with the Contract Administrator or his/her designate, at least two (2) Business Days before delivery.
 - D14.8.2 Goods shall be delivered between 8:00 a.m. and 3:30 p.m. on Business Days.

MEASUREMENT AND PAYMENT

D15. INVOICES – CITY ORDERED GOODS

- D15.1 Where the City directly orders Goods under this Contract, the following shall apply.

D15.2 Further to C10, the Contractor shall submit an invoice for each order delivered to:

The City of Winnipeg
Corporate Finance - Accounts Payable
4th Floor, Administration Building, 510 Main Street
Winnipeg MB R3B 1B9

Facsimile No.: 204 949-0864
Email: CityWpgAP@winnipeg.ca

D15.3 Invoices must clearly indicate, as a minimum:

- (a) the City's purchase order number
- (b) date of delivery;
- (c) delivery address;
- (d) type and quantity of Goods delivered;
- (e) the amount payable with GST, MRST, and any applicable environmental handling charges/fees identified and shown as separate amounts; and
- (f) the Contractor's GST registration number.
- (g) The person placing the order.

D15.4 The Goods delivered and associated amounts payable must be clearly itemized and priced in a manner to allow the City to verify that the proposed pricing and terms of the Contract are being adhered to.

D15.5 The City will bear no responsibility for delays in approval of invoices which are, in the opinion of the Contract Administrator, improperly submitted.

D15.6 Bids Submissions must be submitted to the address in B7.9.

D16. PAYMENT – CITY ORDERED GOODS

D16.1 Further to C10, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

D17. PAYMENT – INSTALLATION CONTRACTOR ORDERED GOODS

D17.1 Payment for Goods ordered by the Installation Contractor will be made by the Installation Contractor.

D17.2 The price shall be based upon the price in effect at the time of order.

D18. PAYMENT SCHEDULE

D18.1 Further to C10, payment shall be in Canadian funds net thirty (30) Calendar Days after receipt and approval of the Contractor's invoice.

D18.2 All payments shall include price adjustments in accordance with Form N.

D18.3 Payment for Form B, Item 15, Programmable Controller Hardware Annual Support and Service shall be prorated based upon the actual quantities of programmable controller systems purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.

D18.4 Payment for Form B, Item 16, Programmable Controller Programming Software Annual Update and Support Service shall be prorated based upon the actual quantities of software licences purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.

- D18.5 Payment for Form B, Item 17, Process Simulator Annual Update and Support Service shall be prorated based upon the actual quantities of software licences purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.6 Payment for Form B, Item 18, Programmable Controller Local Training Session will be made on a per session basis.
- (a) In the event that the quality of training provided does not, in the opinion of the Contract Administrator, meet the specifications and the requirements of the City, the payment may be reduced to reflect the quality of training provided.
- D18.7 Payment for Form B, Item 19, Programmable Controller Local Specialist Training will be made on a per seat basis, and prorated based upon the number of the courses provided.
- (a) In the event that the quality of training provided does not, in the opinion of the Contract Administrator, meet the specifications and the requirements of the City, the payment may be reduced to reflect the quality of training provided.
- D18.8 Payment for Form B, Item 20, HMI Server System Software – Central shall be prorated based upon the list price of the actual Goods delivered. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.9 Payment for Form B, Item 23, HMI Web Server System shall be prorated based upon the list price of the actual Goods delivered. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.10 Payment for Form B, Item 25, Historian Server Software shall be prorated based upon the list price of the actual Goods delivered. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.11 Payment for Form B, Item 26, Historian Client Software / Licence shall be prorated based upon the list price of the actual Goods delivered. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.12 Payment for Form B, Item 29, HMI, Web Server and Historian System Support Software – Annual Update and Support Service shall be prorated based upon the actual quantities of HMI and Historian systems purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.13 Payment for Form B, Item 30, HMI Specialist Training will be made on a per seat basis, and prorated based upon the number of the courses provided.
- (a) In the event that the quality of training provided does not, in the opinion of the Contract Administrator, meet the specifications and the requirements of the City, the payment may be reduced to reflect the quality of training provided.
- D18.14 Payment for custom MCCs (Form B: Item 31) will be based upon the specific MCC calculated list price and the discount entered in Form B, Item 44. The pricing for Form B, Item 31 shall be based upon the indicated discount factor.
- D18.15 Payment for Form B, Item 32, MCC Annual Support Services shall be prorated based upon the actual quantities of MCC components purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.16 Payment for VFDs:
- (a) Payment for 7.5 kW VFDs will be based upon the price indicated in Form B, Item 33. The price shall be consistent with the discount indicated in Form B, Item 45.
- (b) Payment for 37.3 kW VFDs will be based upon the price indicated in Form B, Item 34. The price shall be consistent with the discount indicated in Form B, Item 45.
- (c) Payment for other VFD ratings shall be based upon the discount indicated in Form B, Item 45.

- D18.17 Payment for Form B, Item 36, VFD Annual Support Services shall be prorated based upon the actual quantities of VFDs purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.18 Payment for Form B, Item 38, Historian Central Archive Server Software shall be prorated based upon the actual number of software licences purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.19 Payment for Form B, Item 39, Version Management Software shall be prorated based upon the actual number of software licences purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.20 Payment for Form B, Item 40, Information Server Software shall be prorated based upon the actual number of software licences purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.21 Payment for Form B, Item 41, Metrics Server Software shall be prorated based upon the actual number of software licences purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.
- D18.22 Payment for Form B, Item 42, Enterprise Database Integration Software shall be prorated based upon the actual number of software licences purchased. The basis for pro-rating shall be acceptable to the Contract Administrator.

D19. PROVISION OF AUDIT SERVICES

- D19.1 Upon request by the Contract Administrator, the Contractor shall supply the following:
- (a) A complete list of all orders placed and delivered under the Contract.
 - (b) All invoices for Goods delivered under the Contract, including orders placed by the City or by an Installation Contractor.
 - (c) Evidence that the prices invoiced are consistent with the terms of this Contract.
- D19.2 In the event that it is determined that the price invoiced and paid for Goods exceeded the terms of the Contract, the Contractor shall pay the City the difference.
- D19.2.1 Payment corrections shall apply both the Goods ordered by the City or an Installation Contractor.

WARRANTY

D20. WARRANTY

- D20.1 Warranty is as stated in C11.

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE DRAWINGS

E1.1 The following are applicable to the Work:

<u>Drawing No.</u>	<u>Drawing Name/Title</u>
SK-A0001	Overall HMI Architecture
SK-A0002	Facility HMI Architecture
SK-A0003	Control System Architecture, Typical Facility
SK-A0004	System Architecture, Programmable Controller System 1
SK-A0005	System Architecture, Programmable Controller System 2
SK-A0006	System Architecture, Programmable Controller System 3
SK-E0001	Electrical Single Line Diagram – MCC System 1
SK-E0002	MCC Elevation and Details - MCC System 1
SK-E0003	MCC Schedule - MCC System 1
SK-P0001	Demonstration System, P&ID, Legend and Details (3 sheets)
SK-P0002	Demonstration System, P&ID, Clarifier 1
SK-P0003	Demonstration System, P&ID, Clarifier 2
SK-P0004	Demonstration System, P&ID, Clarifier 3
SK-P0005	Demonstration System, P&ID, Secondary Clarifier Effluent and Sample System
SK-P0006	Demonstration System, P&ID, Return Activated Sludge Pump P-S101
SK-P0007	Demonstration System, P&ID, Return Activated Sludge Pumps P-S102 & P-S103
SK-P0008	Demonstration System, P&ID, Return Activated Sludge Pumps P-S108 & P-S109
SK-P0009	Demonstration System, P&ID, RAS Header
SK-P0010	Demonstration System, P&ID, Waste Activated Sludge Pumps PS202 & P-S203

<u>Filename.</u>	<u>Document Code</u>	<u>Document Name/Title</u>
756-2013_FRS.pdf	756-2013_FRS	Functional Requirements Specification

E2. CRITICAL TECHNICAL QUALIFICATIONS

E2.1 The Programmable Controller, HMI, MCC, and VFDs shall be an integrated solution from a single manufacturer.

- E2.1.1 Third party manufacturers are only permitted for minor components, including:
- (a) Communication modules including Modbus TCP, AS-i, PROFIBUS DP/PA, and Foundation Fieldbus.
 - (b) Infi90 termination unit cables.
 - (c) Process simulator.

E2.2 The manufacturer shall have systems in place to work with multiple independent systems integrators. Control systems that require all systems integration to be performed by the manufacturer or another single entity will not be accepted.

E2.3 Software licences for any runtime component shall not expire.

E3. APPROVED MANUFACTURERS

E3.1 Approved manufacturers, with respect to E2.1 and E2.2, are:

- (a) Rockwell Automation
- (b) Schneider Electric
- (c) Siemens

E3.2 Bidders are reminded that requests for approval of substitutes as an approved equal or an approved alternative shall be made in accordance with B6.

E4. WORK BY OTHERS

E4.1 The detailed design of the control system architecture for the wastewater treatment facilities will be by others, except as required by E8.

E4.2 The integration of the control system equipment into control panels will be by others.

E4.3 The installation of the equipment will be by others.

E4.4 The commissioning of the equipment will be by others, except for indicated start-up services.

E4.5 The supply of networking equipment to connect the programmable controllers with the HMI system will be by others, except as indicated in E13.3(l).

E5. SYSTEM DEMONSTRATION REQUIREMENTS

E5.1 The System Demonstration shall be performed by the Bidder in accordance with B21.

E5.2 Perform all demonstrations with physical hardware, where practical.

E5.3 Set up all demonstrations with Goods proposed in the Bidders proposal submission.

E5.4 System Hardware and Software Requirements

E5.4.1 The demonstration system shall include, but not be limited to the following Programmable Controller equipment:

- (a) A redundant pair of high-end controllers, as per E12.
- (b) A mid-grade controller, as per E13.

E5.4.2 The demonstration system shall include, but not be limited to the following HMI components:

- (a) Redundant HMI servers.
- (b) An HMI client.
- (c) A programming workstation, with all proposed software tools loaded.
- (d) A historian server.
- (e) All proposed software applications installed.
- (f) HMI web server and web client.
- (g) Portable HMI Client

E5.4.3 The demonstration system shall include, but not be limited to the following MCC components:

- (a) A physical MCC structure with a minimum of one VFD and one FVNR intelligent motor starter.

E5.4.4 The demonstration system shall include, but not be limited to the following intelligent instrumentation components:

- (a) An instrumentation fieldbus (PROFIBUS or Foundation Fieldbus) and a minimum of 2 types of connected instruments that can be fully demonstrated.
- (b) A HART connected device.

E5.4.5 The demonstration system shall include, but not be limited to the following additional components as required to provide a complete demonstration system:

- (a) Networking.

E5.4.6 A process simulation system as required to simulate the process and all external field I/O, consistent with the system proposed as per E16.

E5.5 System Application Requirements

E5.5.1 To provide a consistent basis for Bidders, the following shall be utilized as a basis for the demonstration of the Programmable Controllers and HMI.

- (a) System Demonstration Function Requirements Specification (Document number 756-2013_FRS)
- (b) Drawings:
 - (i) SK-P0001
 - (ii) SK-P0002
 - (iii) SK-P0003
 - (iv) SK-P0004
 - (v) SK-P0005
 - (vi) SK-P0006
 - (vii) SK-P0007
 - (viii) SK-P0008
 - (ix) SK-P0009
 - (x) SK-P0010

E5.5.2 Networking

- (a) Provide complete Ethernet-based networking as required to implement and demonstrate the system.

E5.5.3 I/O Simulation

- (a) Provide software simulation of all I/O.

E5.5.4 Minor deviations from the demonstration system specifications will be permitted where they are not significant to the overall operation of the system. This may be appropriate where required to conform to the manufacturer's standard equipment libraries or standard communication with intelligent MCCs.

E5.5.5 Enhancements to the specified requirements are encouraged, where they demonstrate the manufacturer's standard capabilities included with the proposal.

E5.6 System Demonstrations

E5.6.1 General Requirements

- (a) Prior to the demonstrations, ensure that personnel performing the demonstration are familiar with the required demonstrations and simulations.
- (b) Review the demonstration requirements and ensure that a demonstration is prepared to demonstrate each test.
- (c) The functionality provided shall be consistent with the Functional Requirements Specification included with the specification.
- (d) Additional software configuration / programming may be required to perform demonstrations. All software required to be set-up and tested prior to the demonstration.
- (e) Set-up required simulation software and hardware to fully demonstrate the required system.
- (f) Additional tests may be added to the System Demonstration, at any time.
- (g) Provide any additional detailed information, as requested by the Contract Administrator, to verify that the products to be utilized conform to the specification.

E5.6.2 Specific Requirements

- (a) Demonstrate the complete operation of the process indicated by the Functional Requirements Specification Document. Demonstrate the specified functionality.
- (b) Demonstrate the addition of another RAS pump to the control system. No pre-configuration of the additional RAS pump shall be prepared prior to the System Demonstration.
- (c) Demonstrate CPU transfer on CPU failure, and restoration after module replacement.
- (d) Demonstrate capabilities of the proposed mid-grade controller.
- (e) Demonstrate logging of historical data, including recovery after a system failure / shutdown.
- (f) Demonstrate ad-hoc trending and reporting of historical data.
- (g) Demonstrate web client access to the HMI system.
- (h) Demonstrate a portable web client access to the HMI system.
- (i) Demonstrate intelligent motor starter integration.
- (j) Demonstrate VFD integration, including replacement of a failed drive.
- (k) Demonstrate intelligent instrument integration via fieldbus, including the addition of a new device to the fieldbus network.
- (l) Demonstrate the integration of a HART instrument.
- (m) Demonstrate proposed non-mandatory software systems.
- (n) Demonstrate overall integration capabilities of the proposed systems that would be of benefit to the City.

E5.6.3 Additional Demonstration Requirements

- (a) The City may at any time prior to or during the demonstration request additional tests and demonstrations. These may be communicated to the Bidder either in writing or verbally during the system demonstration. The Bidder shall comply with all demonstration requests.

E6. SUBMITTAL PROCEDURES

E6.1 Administrative

- E6.1.1 Submit to Contract Administrator submittals listed for review in accordance with the Specifications, or as requested by the Contract Administrator.
- E6.1.2 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.
- E6.1.3 Do not proceed with Work affected by submittal until review is complete.
- E6.1.4 Present shop drawings, product data, samples and mock ups in SI Metric units.
- E6.1.5 Where items or information is not produced in SI Metric units converted values are acceptable.
- E6.1.6 Review submittals prior to submission to 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.
- E6.1.7 Notify Contract Administrator, in writing at time of submission for review, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- E6.1.8 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.

- E6.1.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- E6.1.10 Acceptance of Shop Drawings for a component or a subassembly does not constitute acceptance of the complete assembly of which it is a part.
- E6.1.11 The Contractor shall make any corrections required by the Contract Administrator and shall resubmit the required number of corrected copies of Shop Drawings. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections requested by the Contract Administrator on previous submission.
- E6.1.12 After Contract Administrator's review and return of copies, distribute copies to sub-trades as appropriate.
- E6.1.13 Keep one reviewed copy of each submission on site.
- E6.2 Shop Drawings and Product Data
- E6.2.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- E6.2.2 The Contractor shall arrange for the preparation of clearly identified Shop Drawings as specified or as the Contract Administrator may reasonably request. Shop Drawings are to clearly indicate materials, weights, dimensions, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop Drawings are to indicate their relationship to design Drawings and Specifications. Notify the Contract Administrator in writing of any deviations in Shop Drawings from the requirements of the Contract Documents.
- E6.2.3 Have Shop Drawings stamped, signed and dated by a Professional Engineer Licensed to practice in the Province of Manitoba where required in the Specifications or by the Contract Administrator.
- E6.2.4 The Contractor shall examine all Shop Drawings prior to submission to the Contract Administrator to ensure that all necessary requirements have been determined and verified and that each Shop Drawing has been checked and coordinated with the requirements of the Work and the Contract Documents. Examination of each Shop Drawing shall be indicated by stamp, date and signature of a responsible person of the sub-contractor for supplied items and of the General Contractor for fabricated items. Shop Drawings not stamped, signed and dated will be returned without being reviewed and stamped "Re-submit". Ensure that the following are verified:
- E6.2.5 Submit shop drawings in a native text-searchable electronic PDF copy (not scanned).
- E6.2.6 Shop Drawing reviews by the Contract Administrator is solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.
- E6.2.7 After submittals are stamped "REVIEWED", "NO EXCEPTIONS TAKEN", "MAKE NOTED CORRECTIONS" or "REVIEWED AS MODIFIED", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.
- E6.2.8 Any adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of Work.
- E6.2.9 Make changes in Shop Drawings, which the Contract Administrator may require, consistent with Contract Documents. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.

- E6.2.10 Show the following information in lower right hand corner of shop drawings.
- (a) Project Title.
 - (b) Tender number or other project number assigned by the Contract Administrator.
 - (c) Name of the depicted item in accordance with the Specifications and Drawings.
 - (d) Project series number and location where the item is used if applicable.
 - (e) Specification section number if applicable
 - (f) Proposed option if applicable.
 - (g) Name of Contractor.

E7. PRODUCT LIFECYCLE GUARANTEE

- E7.1 The manufacturer shall have no plans to remove the proposed control system model series from active sale and/or production within the next five years.
- E7.2 The desired requirement for the control system product lifecycle guarantee is:
- (a) The manufacturer shall have no plans to remove the proposed control system model series from active sale and/or production within the next ten years.
 - (b) Provide guarantee that the Control System equipment, including all programmable controller and HMI equipment and software, will be operable, maintainable and fully supported by the manufacturer for a period of at least twenty-five (25) years from the date of award of the contract.
 - (c) Provide guaranteed spare parts for a period of ten (10) years from the time that any of the proposed products are removed from active sale. This requirement shall exist for all hardware components, except if the hardware component is directly replicable by a newer module without any wiring or software modifications.
- E7.3 The manufacturer shall have no plans to remove the proposed motor control centre model series from active sale and/or production within the next five years.
- E7.4 The desired requirement for the motor control product lifecycle guarantee is:
- (a) Provide guarantee that the motor control centres will be operable, maintainable and fully supported by the manufacturer for a period of at least twenty-five (25) years from the date of delivery to the City.
 - (b) Provide guaranteed spare parts and component repair services for a period of ten (10) years from the time that any of the proposed products are removed from active sale. This requirement shall exist for all hardware components, except if the hardware component is directly replicable by a newer module without any wiring or software modifications.

E8. DESIGN ASSISTANCE

- E8.1 The manufacturer shall, over the life of the contract, provide qualified design engineers and technicians to aid the City in the architecture, configuration, and implementation of the equipment within this Contract.
- E8.2 The design assistance shall also be provided to third-party design engineers working on projects for the City.
- E8.3 The design assistance shall include, but not be limited to:
- (a) Provision of free telephone and e-mail support to design engineers.
 - (b) Provision of standard design guides to guide the City and its design consultants in the design and configuration of the products.

- (c) Review of drawings produced by application design engineers for compliance with manufacturer recommended design guidelines and to ensure their adequacy to meet the requirements of the given application. Identify any issues or suggestions to improve the design.
- (d) Provision of system documentation, tech notes, application guides, and other documentation useful during the design process.

E8.4 Measurement and Payment

- (a) The provision of design assistance services shall be incidental to the Contract, and no payment will be made.

E9. OVERALL SYSTEM REQUIREMENTS

E9.1 The proposed system must be suitable for a wastewater treatment application consisting of three treatment plants.

E9.2 The system must be capable of integrating programmable logic controllers (PLCs) from other manufacturers.

E9.3 The system must provide features that allow for vertical integration with enterprise based systems.

E9.4 The system must allow for redundancy through all aspects of the control system, except as otherwise indicated.

- (a) Redundancy shall be implemented in a manner such that all transitions between redundant modules or communication paths are seamless and transparent to the operator.

E9.5 Complete Fieldbus Integration

- (a) Provide the capability to read/write all variables from intelligent field devices.

E10. PROGRAMMABLE CONTROLLER SYSTEM GENERAL REQUIREMENTS

E10.1 General

E10.1.1 References

- (a) Canadian Standards Associated (CSA International).
 - (i) C22.2 No. 142
- (b) International Electrotechnical Commission (IEC):
 - (i) IEC 61131, Programmable Controllers.

E10.2 Products

E10.2.1 Suitable product will be a PLC/PAC system produced by a major, international industrial automation manufacturer.

- (a) A Distributed Control System (DCS) is permitted provided that it meets the requirements of this RFP, including E2.

E10.2.2 Unless otherwise specifically called for in the Specification, maintain uniformity of manufacturer for all proposed products.

- (a) Desired feature:
 - (i) Minimal, or preferably no, 3rd party components shall be utilized that are directly associated with the programmable controller systems.

E10.2.3 All products proposed to be CSA or c-UL-us listed where applicable.

E10.2.4 Environmental:

- (a) Application: Wastewater treatment.

- (b) The programmable controller system shall be designed and tested to operate in the high electrical noise environment of an industrial plant.
- (c) Operating temperature range, minimum: 0-60°C (32-140°F).
- (d) Operating relative humidity range, minimum: 5-95% (non-condensing).
- (e) Operating vibration limit, minimum: 2g at 10-500Hz.
- (f) Shock operating limit, minimum: 30g

E10.2.5 Modularity

- (a) The construction of the programmable controller is to be modular, utilizing separated modules that are located within or on a common substructure such as a rack or a DIN rail.
- (b) Utilize separate modules for power supplies, processor, and I/O.
- (c) Each module to visibly indicate relevant module status information.
- (d) Common components within the controller system, such as racks or rails, which cannot be removed and replaced on-line to have a minimum of active components.
- (e) Keying systems to be utilized to prevent improper module insertion.
- (f) Module set-up is to be universal and not rely on the use of removable components such as jumpers or shorting bars, or require permanent changes to module components.
- (g) The organization of the modules to follow consistent design practices.

E10.2.6 Support for Remote I/O Architectures

- (a) Native remote I/O capability to minimize wiring costs and to eliminate the need for "home run" wiring.
- (b) Processor module not required in remote racks.
- (c) Support conventional I/O modules located remotely from the main controller.

E10.2.7 Self-Tests, Diagnostics and Failure Modes

- (a) Integrity of controller hardware and software to be constantly monitored by an intrinsic series of continuously running self-tests and diagnostics.
- (b) Immediately report abnormal results as system alarms.
- (c) Have predictable failure mode upon an error. At a minimum, faults are to generate a system alarm.
- (d) Equipment may have the ability to diagnose degradations to performance that may not yet adversely affect operator functions or be a permanent failure. When such conditions are automatically noted, the system is to journal the event in the Historian and have the capability to report such information selectively, as either a system alarm or a message on the programming workstation.

E10.2.8 Processor

- (a) The processor shall be a self-contained unit, and will provide control program execution and support remote or local programming. This device will also supply I/O scanning and inter-controller and peripheral communication functions.
- (b) The processor shall perform internal diagnostic checking and give visual indication to the user by illuminating a "green" LED indicator when no fault is detected and a "red" LED indicator (blinking or solid) when a fault is detected.
- (c) The processor shall give visual indication to the user by illuminating a "red" indicator when I/O forcing is active.
- (d) The front panel of the processor shall include a mounted keyswitch or LCD display with keypad to change the processor between "run" mode, "program" mode, or "stop" mode.

- (e) The operating system firmware can be updated via a separate update tool to allow for easy field updates.
- (f) Memory:
 - (i) Internal memory for storage of user program, internal tag data, and I/O data.
 - (ii) The user program and data shall be contained in battery backed or non-volatile memory. The operating system firmware shall be contained in non-volatile memory.
- (g) Programming:
 - (i) Processor programming to be performed via integrated Ethernet port.
- (h) Desired features:
 - (i) Integrated USB 2.0 programming port.
 - (ii) User program can be downloaded via a removable flash memory such as CompactFlash.
 - (iii) The processor can allow the operating system to be updated using a suitably configured external (removable) memory card.
 - (iv) The processor firmware can be updated via a separate update tool to allow for easy field updates via the network and/or a removable storage card.
 - (v) Minimize the number of processor models proposed.

E10.2.9 Power Supply

- (a) Provide necessary voltages and currents to processor, I/O modules, and ancillary components.
- (b) Provide surge protection and isolation of the input power.
- (c) Power supply to include a diagnostic indicator mounted in a position to be easily viewed by the user. This indicator shall provide the operator with the status of the DC power applied to the backplane.
- (d) Mounting and installation:
 - (i) Programmable controller rack (chassis) or DIN rail,
 - (ii) Field-replaceable without disconnecting processor or I/O modules from rack (chassis) or DIN rail.
- (e) Input voltage:
 - (i) Nominal: 24 VDC.
- (f) Desired features:
 - (i) Minimize the number of power supply modules proposed.
 - (ii) Availability of power supply suitable for 120 VAC, 60 Hz nominal input.
 - (iii) Capability to install hot-swappable redundant power supply modules within each rack / chassis.

E10.2.10 Input/Output (I/O) Modules, General:

- (a) Provide physical interface between field signals and the programmable controller system.
- (b) Installed in programmable controller rack or backplane.
- (c) Provide electrical isolation of circuits between the field and the controller.
- (d) Perform validity checks for all input values.
- (e) Perform self-diagnostics.
- (f) Perform reporting and responding to the controller.
- (g) Hot swappable without stopping the controller.
- (h) I/O module installation and removal:

- (i) All I/O modules may be removed from the chassis or inserted in to the chassis while power is being supplied to the chassis without faulting the controller or damaging the modules.
 - (ii) On-line removal and replacement of a failed module will not required personnel to reconfigure the system software, alter system wiring, de-energize the system, or re-initialize the controller.
- (i) Field wiring:
 - (i) Removable screw-down terminal block, or
 - (ii) Multi-pin connector.
 - (j) Configuration:
 - (i) All configuration changes via software.
 - (ii) Use of jumpers and/or DIP switches for configuration is not acceptable.
 - (k) I/O module power supply:
 - (i) From programmable controller rack or backplane.
 - (l) Desired Features:
 - (i) Minimize the number of I/O module series included in the proposal. Preferably, only one I/O module series is proposed.

E10.2.11 Discrete Input (DI) Modules, 120 VAC, Non-Isolated:

- (a) Input type: Sinking
- (b) Number of channels per module, minimum: 16
- (c) Signal compatibility:
 - (i) Nominal: 120 VAC, 60 Hz.
 - (ii) Tolerance range, minimum: 100-132 VAC, 47-63 Hz.
- (d) Voltage thresholds:
 - (i) Off state, maximum: 40 VAC
 - (ii) On state, minimum: 74 VAC
- (e) Input impedance, minimum: 10.15 kΩ at 60 Hz.
- (f) Indicating LEDs:
 - (i) Channel status (on/off) for each channel,
 - (ii) Module Error/Fault.

E10.2.12 Discrete Input (DI) Modules, 24 VDC, Non-Isolated:

- (a) Input type: Sinking
- (b) Number of channels per module, minimum: 16
- (c) Signal compatibility:
 - (i) Nominal: 24 VDC,
 - (ii) Tolerance range, minimum: 10-30 VDC.
- (d) Voltage thresholds:
 - (i) Off state, maximum: 5 VDC
 - (ii) On state, minimum: 11 VDC
- (e) Indicating LEDs:
 - (i) Channel status (on/off) for each channel,
 - (ii) Module Error/Fault.

E10.2.13 Discrete Output (DO) Modules, 120VAC:

- (a) Output Type: Sourcing
- (b) Number of channels per module, minimum: 16
- (c) Signal compatibility:

- (i) Nominal: 120 VAC, 60 Hz.
 - (ii) Tolerance range, minimum: 74-132 VAC, 47-63 Hz.
- (d) Output current rating:
- (i) Per channel, minimum: 0.5 Amps.
- (e) Indicating LEDs:
- (i) Channel status (on/off) for each channel,
 - (ii) Module Error/Fault.

E10.2.14 Discrete Output (DO) Modules, 24 VDC:

- (a) Output Type: Sourcing
- (b) Number of channels per module, minimum: 16
- (c) Signal compatibility:
 - (i) Nominal: 24 VDC.
- (d) Output current rating:
 - (i) Per channel, minimum: 2 Amps.
- (e) Voltage Drop, maximum: 1.2 V at 2 Amps.
- (f) Indicating LEDs:
 - (i) Channel status (on/off) for each channel,
 - (ii) Module Error/Fault.

E10.2.15 Discrete Output (DO) Modules, Relay:

- (a) Output type: Dry-contact, Form A (normally open)
- (b) Number of channels per module, minimum: 8
- (c) Relay contact voltage threshold:
 - (i) Direct Current (DC), minimum: 10 to 34 VDC
 - (ii) Alternating Current (AC), minimum: 10 to 240 VAC
- (d) Relay contact current ratings:
 - (i) 120 VAC, minimum: 2 Amps
 - (ii) 24 VDC, minimum: 2 Amps
 - (iii) 5 VDC, minimum: 1 Amp
- (e) Service life of contacts:
 - (i) Service life of contacts, minimum: 100,000 cycles at 120 VAC
- (f) Indicating LEDs:
 - (i) Channel status (on/off) for each channel,
 - (ii) Module Error/Fault.

E10.2.16 Analog Input (AI) Modules:

- (a) Number of channels per module, minimum: 4
- (b) Signal compatibility:
 - (i) +/- 10 VDC
 - (ii) +/- 5 VDC
 - (iii) 4-20 mA
 - (iv) 0-20 mA
- (c) Measurement error:
 - (i) At 25°C, maximum: 0.075% of full-scale
 - (ii) Over entire operating temperature range, maximum: 0.1% of full-scale

- (d) Input Impedance:
 - (i) Voltage signals, minimum: 10 M Ω
 - (ii) Current signals, maximum: 250 Ω
- (e) Hardware resolution:
 - (i) Minimum: 15 bit
 - (ii) Desired feature: 16 bit
- (f) Common mode noise rejection, minimum: 60 dB at 60 Hz.
- (g) Indicating LEDs:
 - (i) Module error/fault.
- (h) Desired features:
 - (i) Galvanic isolation between channels.

E10.2.17 Analog Output (AO) Modules:

- (a) Number of channels per module, minimum: 4
- (b) Signal compatibility:
 - (i) +/- 10 VDC
 - (ii) 4-20 mA
 - (iii) 0-20 mA
- (c) Measurement error:
 - (i) At 25°C, maximum: 0.1% of full-scale
 - (ii) Over entire operating temperature range, maximum: 0.2% of full-scale
- (d) Hardware resolution: 16 bits
- (e) Galvanic isolation between channels.

E10.2.18 RTD Input Modules:

- (a) Number of channels per module, minimum: 4
- (b) RTD type compatibility, minimum: PT100
- (c) RTD Wiring: 2-wire and 3-wire compatible
- (d) Software Engineering Units: °C, °F
- (e) Indicating LEDs:
 - (i) Channel error/fault.
 - (ii) Module error/fault.

E10.2.19 Thermocouple Input Modules:

- (a) Number of channels per module, minimum: 4
- (b) Thermocouple type compatibility, minimum: B, C, E, J, K, N, R, S, T
- (c) Compensation:
 - (i) Cold junction compensation.
- (d) Software Engineering units: °C, °F
- (e) Channel isolation: Galvanic isolation between channels.
- (f) Indicating LEDs:
 - (i) Channel error/fault.
 - (ii) Module error/fault.

E10.2.20 Remote I/O Network Interface Modules:

- (a) Provide ability to read and write data over wired communication networks to multiple remote racks and field devices such as MCCs and VFDs.
- (b) Network medium: Ethernet

- (c) Network speed, minimum: 100 Mbit
- (d) Network connector: RJ45
- (e) Fibre optic compatibility:
 - (i) It shall be possible to communicate with remote I/O racks or other programmable controllers via fiber optic cable by inserting fiber optic converters into the links.
- (f) Indicating LEDs:
 - (i) Link status,
 - (ii) Module error/fault.

E10.2.21 HMI System and Engineering Workstation Network Interface Modules:

- (a) Provide point of communication to HMI system and data historian for display and logging of real-time data.
- (b) Facilitate remote connection between programmable controller and engineering workstation for online editing of program.
- (c) Network medium: Ethernet, shielded twisted pair.
- (d) Network speed: 100 Mbit.
- (e) Network connector: RJ45.
- (f) Fibre optic compatibility:
 - (i) It shall be possible communicate with HMI systems via fiber optic cable by inserting fiber optic converters into the links.
- (g) Indicating LEDs:
 - (i) Link status,
 - (ii) Module error/fault.

E10.2.22 HART Communication Modules:

- (a) In-rack modules or external module for communication with multiple HART-enabled field devices over existing 4-20mA twisted pair cabling.
- (b) Support both reading and writing of HART protocol data to/from field devices.
- (c) Facilitate field device configuration.
- (d) For external (non-rack mounted) modules:
 - (i) Power supply input voltage, nominal: 24 VDC
 - (ii) Communication ports, protocols, and cabling: compatible with programmable controller system.
- (e) HART protocol compatibility:
 - (i) HART versions: 5, 6, and 7.
- (f) Desired features:
 - (i) In-rack module.
 - (ii) Manufactured by same manufacturer as programmable controllers.
 - (iii) HART functions supported in proposed programmable controller programming software (i.e. does not require use of 3rd party software).

E10.2.23 Modbus TCP Communication Modules

- (a) Support for the Modbus TCP communication via manufacturer or 3rd party modules.
- (b) Support for at minimum 16 connections per module, allowing simultaneous communication with up to 16 Modbus-enabled devices.
- (c) The communication capability may be provided by either an in-rack or out-of-rack module.

- (d) Desired features:
 - (i) Modbus TCP communication capability is native to the processor, and/or
 - (ii) In-rack module, interfacing directly with processor via rack backplane.

E10.2.24 Desired Feature: Fieldbus Interface Modules

- (a) In-rack module interfacing directly with the processor via rack backplane.
- (b) Support for one or both of the following:
 - (i) Profibus DP/PA
 - (ii) Foundation Fieldbus
- (c) Fieldbus modules to be certified by appropriate organization (Profibus International / Foundation Fieldbus)

E10.2.25 Desired Feature: AS-Interface Integration

- (a) Provide an in-rack module for interfacing with AS-interface devices.

E10.2.26 Desired Feature: Specialty Modules

- (a) Provide in-rack specialty modules to perform the following features:
 - (i) High-Speed Counting
 - (ii) RTD Input
 - (iii) Thermocouple Input
 - (iv) And other specialty application.

E10.2.27 Rack:

- (a) Slotted rack/chassis for inserting modules including power supply, processor, I/O modules, communication modules, and rack expansion modules where required.
- (b) Distribute power from attached power supply to modules inserted into rack.
- (c) Signal bus for passage of signals between modules.
- (d) Mounting holes to facilitate fastening rack to enclosure back-panel.
- (e) Various rack sizes available, ranging at minimum from 4 to 12 slots.
- (f) Provide documentation indicating:
 - (i) Required horizontal and vertical clearances around rack for cooling of rack-mounted components.
 - (ii) Total mounting depth of rack and modules.

E10.2.28 Rack expansion modules:

- (a) As required for extension of rack.
- (b) Where rack expansion modules are proposed, indicate requirements for rack expansion modules, cabling, and terminations.

E10.3 Redundancy Capabilities:

- (a) Where processor redundancy is specified:
 - (i) The redundant processors shall provide higher system availability. This shall be realized by switching control to a secondary processor if the primary processor fails.
 - (ii) Redundant controllers to not duplicate communication to remote I/O under normal operation.
 - (iii) Failover to redundant controller to take 100ms or less.
 - (iv) A programmable controller system utilizing redundant processors shall be realized using standard versions of the chassis, power supplies, I/O modules, and communication adapters.
 - (v) It shall be possible to implement redundancy without additional programming.
 - (vi) The redundant processors shall be able to operate without any local I/O, and having all I/O configured as remote I/O.

- (vii) The switch over between primary and secondary processor shall happen transparent to the user and to the application.
- (viii) The system shall guarantee a bumpless switchover for all outputs. Outputs shall never revert to a previous state because of a switchover event.
- (ix) The system shall provide an automatic program cross-load and synchronization. The program shall be downloaded only to the primary processor. Using this design, it shall eliminate the need for maintaining separate programs for the primary and the secondary processors. A processor, configured as a secondary, shall automatically receive and buffer data changes from the primary processor.
- (x) To minimize the potential for common cause failures, redundant controllers shall be able to be physically separated (not located in a common backplane) by up to 1,000 m. It is not permissible to share a common backplane.

E10.4 Hardware Configuration Requirements:

- (a) Addition or removal of I/O modules, including remote I/O modules, and associated software configuration changes, will not require interruption of controller processing.
- (b) Addition or removal of a remote I/O communication drop, and associated software configuration changes, will not require interruption of controller processing for other I/O drops.
- (c) Modification of I/O module configuration and parameters, including setting the type and range of individual I/O points, will not require interruption of controller processing.
- (d) Interruption of one processor is acceptable, provided the redundant processor is controlling the process during this period, with no interruption to the process.

E10.5 Desired Feature: Hardened Remote I/O Option

- (a) Provide an option for a remote I/O model series that is hardened for extended temperature operating range and more corrosive environments. Module to have conformal coating.

E10.6 Miscellaneous Features

E10.6.1 Desired Feature – Timestamping:

- (a) Timestamp all point state/value changes at the controller and pass the timestamps to the HMI and Historian.

E10.6.2 Desired Feature – Quality Flags:

- (a) Implement a quality flag for all signals that propagate from the input module all the way through to the HMI.
- (b) Automatically generate bad quality status for inputs and calculated variables.
- (c) A value shall be declared bad quality if any of the following conditions are true:
 - (i) If a value is out of range.
 - (ii) If a value cannot be measured or calculated.
 - (iii) If a value is declared invalid by an application program.
 - (iv) If a value is declared invalid by the source instrument.
- (d) It shall be possible for a bad quality status to be used as a logical input to initiate control algorithm changes.
- (e) When a control algorithm's input is declared bad quality, it shall be possible to configure the output to fail as follows:
 - (i) Hold last good value.
 - (ii) Zero output signal.
 - (iii) User defined output value.

E11. PROGRAMMABLE CONTROLLER SYSTEM 1

- E11.1 Programmable Controller System 1 represents a system required to replace an existing ABB/Bailey Infi90 DCS for a specific process area.
- E11.2 The general requirements are indicated in E10.
- E11.3 Programmable Controller System 1 is a comprehensive programmable controller system, as per drawing SK-A0004. It shall include, but not be limited to, the following components:
- (a) Racks, backplanes, and/or chassis as applicable.
 - (b) Power supply modules.
 - (c) Redundant processors.
 - (d) Communication modules.
 - (e) Fieldbus modules.
 - (f) External gateways required to meet specifications.
 - (g) Rack / Chassis blank cover plates for unused module locations.
 - (h) I/O modules.
 - (a) I/O modules to be compatible with Infi90 termination unit cables.
 - (i) Specialty components required for:
 - (a) HART,
 - (b) Fieldbus connectivity,
 - (j) Removable terminal blocks or cordsets for I/O modules.
 - (k) Infi90 termination unit (TU) connection cables.
 - (a) Which are specified and priced separately.
 - (l) Specialty cables where required.
 - (m) Ethernet switches for all Remote I/O, MCC, and VFD connections.
 - (i) It may be assumed that the switches within the MCCs are addressed within the MCC portion of the work.
 - (n) PROFIBUS and other fieldbus connectors as applicable.
 - (o) Modbus TCP gateway modules as required.
 - (p) Any other components required.
- E11.4 Programmable Controller System 1 does not include:
- (a) Any HMI systems, which are addressed in other sections of this RFP.
 - (b) Network cables.
 - (c) Field wiring.
 - (d) 120 VAC to 24 VDC power supplies, unless required to be specific by the manufacturer.
- E11.5 Programmable Controller Power Supply Requirements:
- (a) General:
 - (i) One power supply per rack (chassis).
 - (b) Input voltage: 24 VDC
 - (c) Rating: Suitable for processor and quantity of I/O and communication modules utilized.
- E11.6 Processor Requirements:
- (a) Memory:
 - (i) As required for application plus 100% expansion capability.

- (b) Redundancy:
 - (i) Two processors in redundant configuration. One processor in active operation and one processor in hot standby.
- (c) The processors shall have sufficient computing power to handle the indicated I/O, plus 100% expansion.
- (d) Desired features:
 - (i) The processor shall be identical to that proposed for Programmable Controller System 2.
 - (ii) Processor scan time for indicated application: < 50 ms
 - (iii) Processor scan time for indicated application with 100% expansion: < 50 ms

E11.7 Application Requirements

E11.7.1 Local I/O – None.

E11.7.2 Remote I/O – DCS Cabinet 1

- (a) 120 VAC Discrete Inputs: 160 points
 - (i) The module proposed must be compatible with the proposed cordset for terminations on the existing TUs.
- (b) 24 VDC Discrete Outputs: 64 points
- (c) Analog Inputs – 4-20 mA: 32 points
- (d) Analog Outputs – 4-20 mA: 16 points

E11.7.3 Remote I/O – DCS Cabinet 2

- (a) 120 VAC Discrete Inputs: 160 points
 - (i) The module proposed must be compatible with the proposed cordset for terminations on the existing TUs.
- (b) 24 VDC Discrete Outputs: 64 points
- (c) Analog Inputs – 4-20 mA: 32 points
- (d) Analog Outputs – 4-20 mA: 16 points

E11.7.4 Remote I/O Node 3:

- (a) 24 VDC Discrete Inputs: 128 points
- (b) 24 VDC Discrete Outputs: 32 points
- (c) Analog Inputs – 4-20 mA: 16 points
- (d) Analog Inputs – HART: 16 points
- (e) Analog Outputs – HART: 8 points

E11.7.5 Networked Devices:

- (a) Intelligent Motor Starters: -
- (b) Variable Frequency Drives: 8 Devices
- (c) Fieldbus Instruments: -
- (d) Modbus TCP Devices: 8 Devices

E11.7.6 Control Loops:

- (a) PID Control Loops:
 - (i) Quantity: 48
 - (ii) Calculation Interval: 500 ms
- (b) Discrete Logic Requirements:
 - (i) Assume discrete logic requirements based upon typical wastewater treatment applications.

E11.8 Communication Requirements:

- (a) Ethernet port with RJ45 connector for controller programming from PC workstation / laptop and connection to the HMI system.
 - (i) Integral to processor or via separate communication module.
- (b) Remote I/O modules for communication to I/O rack(s) where remote rack(s) are utilized for the I/O modules.

E11.9 Fieldbus Requirements

- (a) The programmable controller shall have capability to integrate an intelligent MCC and/or individual VFDs via the proposed protocol for motor control.

E11.10 Desired Features:

- (a) Physical dimensions of Programmable Controller System 1 components to allow for horizontal mounting within the existing ABB/Bailey Infi90 DCS cabinets (19 inch rack cabinets).

E12. PROGRAMMABLE CONTROLLER SYSTEM 2

E12.1 Programmable Controller System 2 represents a high-end redundant system required for control of a major process train.

E12.2 The general requirements are indicated in E10.

E12.3 Programmable Controller System 2 is a comprehensive system, as per drawing SK-A0005. It shall include, but not be limited to, the following components:

- (a) Racks, backplanes, and/or chassis as applicable.
- (b) Power supply modules.
- (c) Redundant processors.
- (d) Communication modules.
- (e) Fieldbus modules.
- (f) External gateways required to meet specifications.
- (g) Rack / Chassis blank cover plates for unused module locations.
- (h) I/O modules.
- (i) Removable terminals blocks or cordsets for I/O modules.
- (j) Specialty cables where required.
- (k) Ethernet switches for all Remote I/O, MCC, and VFD connections.
 - (a) It may be assumed that the switches within the MCCs are addressed within the MCC portion of the work.
- (l) PROFIBUS and other fieldbus connectors as applicable.
- (m) Any other components required.

E12.4 Programmable Controller System 2 does not include:

- (a) Any HMI systems, which are addressed in other sections of this RFP.
- (b) Network cables.
- (c) Field wiring.
- (d) 120 VAC to 24 VDC power supplies, unless required to be specific by the manufacturer.
- (e) Profibus Redundancy Module.
- (f) Profibus DP/PA converter.

E12.5 Programmable Controller Power Supply Requirements:

- (a) General:
 - (a) One power supply per rack (chassis).
- (b) Input voltage: 24 VDC
- (c) Rating: Suitable for processor and quantity of I/O and communication modules utilized.

E12.6 Processor Requirements:

- (a) Memory:
 - (a) As required for application plus 100% expansion capability.
- (b) Redundancy:
 - (a) Two processors in redundant configuration. One processor in active operation and one processor in hot standby.
- (c) The processors shall have sufficient computing power to handle the indicated I/O, plus 100% expansion.
- (d) Desired Features:
 - (a) The processor shall be identical to that proposed for Programmable Controller System 1.
 - (b) Processor scan time for indicated application: < 50 ms
 - (c) Processor scan time for indicated application with 100% expansion: < 50 ms

E12.7 Application Requirements:

E12.7.1 Remote I/O Node 1:

- (a) 24 VDC Discrete Inputs: 160 points
- (b) 24 VDC Discrete Outputs: 32 points
- (c) Analog Inputs – 4-20 mA: 16 points
- (d) Analog Inputs – HART: 32 points
- (e) Analog Outputs – 4-20 mA: 8 points
- (f) Analog Outputs – HART: 8 points

E12.7.2 Remote I/O Node 2:

- (a) 24 VDC Discrete Inputs: 160 points
- (b) 24 VDC Discrete Outputs: 32 points
- (c) Analog Inputs – 4-20 mA: 16 points
- (d) Analog Inputs – HART: 32 points
- (e) Analog Outputs – 4-20 mA: 8 points
- (f) Analog Outputs – HART: 8 points

E12.7.3 Remote I/O Node 3:

- (a) 24 VDC Discrete Inputs: 128 points
- (b) 24 VDC Discrete Outputs: 32 points
- (c) Analog Inputs – 4-20 mA: 16 points
- (d) Analog Inputs – HART: 16 points
- (e) Analog Outputs – HART: 8 points

E12.7.4 Remote I/O Node 4:

- (a) 24 VDC Discrete Inputs: 128 points
- (b) 24 VDC Discrete Outputs: 32 points

- (c) Analog Inputs – 4-20 mA: 16 points
- (d) Analog Inputs – HART: 16 points
- (e) Analog Outputs – HART: 8 points

E12.7.5 Networked Devices:

- (a) Intelligent Motor Starters: 40 devices
- (b) Variable Frequency Drives: 16 devices
- (c) Fieldbus Instruments: 34 devices

E12.7.6 Control Loops:

- (a) PID Control Loops:
 - (i) Quantity: 48
 - (ii) Calculation Interval: 500 ms
- (b) Discrete Logic Requirements:
 - (i) Assume discrete logic requirements based upon typical wastewater treatment applications.

E12.8 Communication Requirements:

- (a) Ethernet port with RJ45 connector for controller programming from PC workstation / laptop and connection to the HMI system.
 - (i) Integral to processor or via separate communication module.
- (b) Remote I/O modules for communication to I/O rack(s) where remote rack(s) are utilized for the I/O modules.

E12.9 Fieldbus Requirements:

- (a) The programmable controller shall have capability to integrate an intelligent MCC and/or individual VFDs via the proposed protocol for motor control.
- (b) The programmable controller shall have the capability to integrate Profibus DP and/or Foundation Fieldbus devices with redundant communication channels.

E13. PROGRAMMABLE CONTROLLER SYSTEM 3

E13.1 Programmable Controller System 3 represents a mid-grade system required for control of a minor process train or an auxiliary process such as HVAC.

E13.2 The general requirements are indicated in E10.

E13.3 Programmable Controller System 3 is a comprehensive system, as per drawing SK-A0006. It shall include, but not be limited to, the following components:

- (a) Racks, backplanes, and/or chassis as applicable.
- (b) Power supply modules.
- (c) Programmable controller / processor.
- (d) Communication modules.
- (e) Fieldbus modules.
- (f) External gateways required to meet specifications.
- (g) Rack / Chassis blank cover plates for unused module locations.
- (h) I/O modules.
- (i) Removable terminals blocks or cordsets for I/O modules.
- (j) Specialty cables where required.

- (k) Ethernet switches for all Remote I/O, MCC, and VFD connections.
 - (a) It may be assumed that the switches within the MCCs are addressed within the MCC portion of the work.
 - (l) A dual-homing Ethernet switch, if dual network connections to the process control network are not otherwise proposed.
 - (m) PROFIBUS connectors as applicable.
 - (n) Any other components required.
- E13.4 Programmable Controller System 3 does not include:
- (a) Any HMI systems, which are addressed in other sections of this RFP.
 - (b) Network cables.
 - (c) Field wiring.
 - (d) 120 VAC to 24 VDC power supplies, unless required to be specific by the manufacturer.
- E13.5 Programmable Controller Power Supply Requirements:
- (a) Input voltage: 24 VDC
 - (b) Rating: Suitable for processor and quantity of I/O and communication modules utilized.
- E13.6 Processor Requirements:
- (a) Memory:
 - (a) As required for application, plus 100% expansion capability.
 - (b) The processors shall have sufficient computing power to handle the indicated I/O, plus 100% expansion.
- E13.7 Application Requirements:
- E13.7.1 Local I/O
- (a) 24 VDC Discrete Inputs: 32 points
 - (b) 24 VDC Discrete Outputs: 16 points
 - (c) Analog Inputs – 4-20 mA: 16 points
 - (d) Analog Outputs – 4-20 mA: 8 points
- E13.7.2 Remote I/O Node 1
- (a) 24 VDC Discrete Inputs: 16 points
 - (b) Analog Inputs – 4-20 mA: 8 points
- E13.7.3 Networked Devices
- (a) Intelligent Motor Starters: 8 devices
 - (b) Variable Frequency Drives: 4 devices
- E13.7.4 Control Loops
- (a) PID Control Loops:
 - (i) Quantity: 8
 - (ii) Calculation Interval: 500 ms
 - (b) Discrete Logic Requirements:
 - (i) Assume discrete logic requirements based upon typical wastewater treatment applications.

E13.8 Communication Requirements:

- (a) Ethernet port with RJ45 connector for controller programming from PC workstation / laptop and connection to the HMI system.
 - (a) Integral to processor or via separate communication module.
- (b) Remote I/O modules for communication to I/O rack(s).

E13.9 Fieldbus Requirements:

- (a) The programmable controller shall have capability to integrate an intelligent MCC and/or individual VFDs via the proposed protocol for motor control.
- (b) Desired Feature: Native Ethernet/IP support
- (c) Desired Feature: Native Modbus TCP support
- (d) Desired Feature: Native PROFIBUS DP support
- (e) Desired Feature: Native Foundation Fieldbus support
- (f) Desired Feature: Native AS-Interface (AS-i) Fieldbus support
- (g) Desired Feature: Native HART Fieldbus support

E14. INFI90 TERMINATION UNIT CABLES

E14.1 Provide preconfigured cables for direct connection between Bailey/ABB Infi90 Termination Units and programmable controller I/O modules.

E14.2 Infi90 NRAI01 TU AI Cable

- (a) Pre-manufactured cable for connection of Infi90 NRAI01 termination unit to a programmable controller Analog Input Module, 4-20 mA.
- (b) Note that the existing TUs are typically connected to an ABB Infi90 IMFEC12 analog input module with a NKTU02 cable.

E14.3 Infi90 NRAO01 TU AO Cable

- (a) Pre-manufactured cable for connection of Infi90 NRAO01 termination unit to a programmable controller Analog Output Module, 4-20 mA.
- (b) Note that the existing TUs are typically connected to an ABB Infi90 IMASO01 analog output module with a NKTU02 cable.

E14.4 Infi90 NRDI01 TU DI Cable

- (a) Pre-manufactured cable for connection of Infi90 NRDI01 termination unit to a programmable controller 120 VAC Discrete Input Module.
- (b) Note that the existing TUs are typically connected to an ABB Infi90 IMDSI02 discrete input module with a NKTU02 cable.

E14.5 Infi90 NRDO02 TU DO Cable

- (a) Pre-manufactured cable for connection of Infi90 NRDO02 termination unit to a programmable controller 24 VDC Discrete Output Module.
- (b) Note that the existing TUs are typically connected to an ABB Infi90 IMDSO04 discrete output module with a NKTU02 cable.

E14.6 Infi90 NTAI05 TU AI Cable

- (a) Pre-manufactured cable for connection of Infi90 NTAI05 termination unit to a programmable controller Analog Input Module, 4-20 mA.
- (b) Note that the existing TUs are typically connected to an ABB Infi90 analog input module with a NKTU01 cable.

E14.7 Infi90 NTDI01 TU DI Cable

- (a) Pre-manufactured cable for connection of Infi90 NTDI01 termination unit to a programmable controller 120 VAC Discrete Input Module.
- (b) Note that the existing TUs are typically connected to an ABB Infi90 discrete input module with a NKTU01 cable.

E14.8 Infi90 NTDI01 TU AO Cable

- (a) Pre-manufactured cable for connection of Infi90 NTDI01 termination unit to a programmable controller Analog Output module, 4-20mA.
- (b) Note that the existing TUs are typically connected to an ABB Infi90 analog output module with a NKTU01 cable.

E14.9 Infi90 NTDO01 TU DO Cable

- (a) Pre-manufactured cable for connection of Infi90 NTDO01 termination unit to a programmable controller 24 VDC Discrete Output Module.
- (b) The cable must support 16 outputs as the termination units may be daisy chained.
- (c) Note that the existing TUs are typically connected to an ABB Infi90 NDSM05 discrete output module with a NKTU01 cable.

E14.10 Infi90 NTDO02 TU DO Cable

- (a) Pre-manufactured cable for connection of Infi90 NTDO02 termination unit to a programmable controller 24 VDC Discrete Output Module.
- (b) The cable must support 16 outputs as the termination units may be daisy chained.
- (c) Note that the existing TUs are typically connected to an ABB Infi90 NDSM05, IMDSO04, or IMDSO14 discrete output module with a NKTU01 cable.

E14.11 Termination Unit End: Appropriate connector for termination unit specified.

E14.12 I/O module End: Appropriate connector for snap in termination. Loose wires (flying leads) are not acceptable.

E14.13 Length:

- (a) The cables shall be available in various lengths to meet the application requirements.
- (b) The baseline length for Form B pricing shall be 5.0 m.
- (c) Desired feature:
 - (i) The cables will be available in custom lengths.

E15. PROGRAMMABLE CONTROLLER PROGRAMMING SOFTWARE

E15.1 The programmable controller programming software shall be comprised of all software and licences to program, maintain, and support the complete feature set of the programmable controllers proposed. All additional software components shall be included, if the additional component in any way relates to this RFP or the proposal submitted.

- (a) Desired feature:
 - (i) It is preferred to have all controller software programming functions in one integrated software package.

E15.2 Programmable controller programming software developed by same manufacturer as the programmable controller hardware. Use of 3rd party programming software will not be accepted.

E15.3 General Requirements:

- (a) Programming software to be IEC 61131-3 compliant.
- (b) The software shall facilitate programming in a modular approach, with multiple tasks, programs, and subroutines.
- (c) User-definable program/task execution: Continuous, periodic, and on-demand.
 - (i) Periodic programs/tasks are capable of being configured to run at a user-defined interval over the range of 1 millisecond to 60 seconds.
 - (ii) Periodic programs/tasks shall have an associated, user-assignable priority level, which specifies the relative execution priority where multiple programs/tasks are utilized.
 - (iii) Programs/tasks can be triggered on-demand by hardware events (an input point) or software events (event instruction).
- (d) Support for the following languages:
 - (i) Ladder Logic,
 - (ii) Function Block Diagram,
 - (iii) Structured Text,
 - (iv) Instruction List, and
 - (v) Sequential Function Chart.

E15.4 Program tags:

- (a) Tag naming convention compliant with IEC 61131-3:
- (b) Support alpha-numeric tag names up to 32 characters in length.
- (c) Support internal tags that are not mapped to any I/O point.
- (d) Support user-defined data types (structures) being comprised of elementary data types and/or other user-defined data types (structures).

E15.5 User-defined functions:

The software shall include the ability to create user defined functions that are re-usable in one or multiple projects/applications. These functions will allow for the encapsulation of code developed by the user using the standard instruction set and other user defined functions. The user defined functions can be instantiated multiple times, each instance of the instruction having its own backing data and the ability to create custom online help for each user defined instruction.

E15.6 Program modification and execution:

- (a) Support online editing of program with programmable controller in run mode.
- (b) Online changes can be downloaded to programmable controller without stopping programmable controller program execution.
- (c) Software provides ability to stop and start programmable controller program execution.

E15.7 I/O forcing:

- (a) It shall be possible to manually set (force) either on or off all hardwired discrete input or output points from the programming panel. It shall also be possible to manually set (force) an analog input or output to a user specified value. Removal of these forced I/O points shall be achieved either individually or totally through selected keystrokes. The programming terminal shall be able to display forced I/O points.

E15.8 Hardware compatibility:

- (a) Single version of programmable controller software compatible with proposed processor(s) for the following programmable controller systems:
 - (i) Programmable Controller System 1, per E11.
 - (ii) Programmable Controller System 2, per E12.

- (iii) Programmable Controller System 3, per E13.
 - (b) Facilitate integration of intelligent MCCs, VFDs, and soft starters through automatic creation of pre-configured tag structures and/or logic to reduce programming efforts.
- E15.9 Controller Emulation:
- (a) Provide the ability to simulate the execution of a controller utilizing a Windows application. The controller shall execute any user program.
 - (b) Desired Features:
 - (a) It shall be possible to execute multiple controllers simultaneously on the same system.
 - (b) The simulation capability shall match the hardware controller capability 100%. No functions / features shall not be emulated.
 - (c) The controller emulation shall have the means to emulate network connected motor starters and VFDs.
 - (d) The controller emulation shall have the means to emulate fieldbus connected instruments.
- E15.10 Audit Trail:
- (a) Desired Feature:
 - (i) Automatically log all modifications, downloads, system changes, etc to the controller into a secure audit trail. The audit log shall include the date, time, user, and a detailed description of the operation performed.
- E15.11 Library:
- (a) Desired features
 - (i) Fuzzy logic control block library,
 - (ii) PID controller auto-tuning.
 - (iii) Smith-predictor,
 - (iv) Lead-Lag feed forward control
- E15.12 Operating System Compatibility:
- (a) Microsoft Windows 7
- E15.13 Licence Model
- E15.13.1 The programming software shall not expire.

E16. PROCESS SIMULATOR

- E16.1 The process simulator shall be comprised of all software and licences to program, and implement a process simulator.
- E16.1.1 Provide a means to simulate all field devices external to the programmable controller, such as I/O, networked devices, and fieldbus instruments.
- E16.1.2 The purpose of the process simulator is to allow for control system testing and training.
- E16.2 The process simulator may be implemented via one of the following methods.
- (a) Specific software designed for process simulation.
 - (b) A HMI development/runtime instance where the HMI with programming / scripting ability provides the required simulation interface.
 - (c) Utilization of watch windows and custom code in the controller program is not deemed to meet the requirements of this section.

E16.3 Communication Capabilities

- (a) Provide means to communicate with the proposed programmable controllers. Communication capabilities shall emulate discrete and analog I/O, networked devices, and fieldbus instruments.
- (b) Provide means to communicate with the programmable controller emulator.

E16.4 Programming Capabilities

- (a) Provide an easy-to-use programming / scripting language to simulate equipment and process functionality.
- (b) Simulate the action of the process by monitoring controller outputs and manipulating controller inputs.
- (c) Example functions include, but are not limited to the following:
 - (i) Turn on the motor running signal upon receiving the run command.
 - (ii) Open / close the valve based upon the valve command signal.
 - (iii) Adjust the flowmeter flow based upon the flow split across multiple valve positions.
 - (iv) Adjust the supply air temperature based upon a semi-random outdoor air temperature and the heating coil valve position.
 - (v) Simulate the wastewater dissolved oxygen based upon incoming wastewater flows, a specified non-linear function, and a random component.
- (d) Provide a means to activate and deactivate the execution of the simulator, preferably on a modular basis.

E16.5 Interface Capabilities

- (a) Provide customizable process simulation windows where I/O and networked/fieldbus communication associated with a unit of equipment / system may be collected, viewed, and easily edited. Provide a separate window for the I/O associated with each equipment / system.
- (b) Provide a graphical screen that allows the user to quickly navigate to various process areas, and control the equipment / process.

E16.6 Scenario Capabilities

- (a) Desired Feature:
 - (i) Provide a means to record and reload a scenario of simulated events, to allow for training scenarios. For example, the scenario could simulate the upset of a process.

E16.7 Simulation Scope

- (a) The simulator must be able to, at minimum, simulate the entire process under the control of a single programmable controller.
- (b) Desired Feature:
 - (i) It is desired to provide a means to simulate an entire facility at a given time.

E16.8 Operating System Compatibility:

- (a) Microsoft Windows 7

E16.9 Licence Model

E16.9.1 The process simulator software shall not expire.

E16.9.2 Development and runtime licences shall be included.

E16.9.3 Desired feature:

- (a) It is desired to have sufficient licensing to allow for flexible process simulation of any potential application.

E17. PROGRAMMABLE CONTROLLER HARDWARE ANNUAL SUPPORT SERVICE

E17.1 The support service shall include the following:

E17.1.1 Provide telephone technical support, available from 8 am to 4 pm CST, Monday to Friday.

E17.1.2 Provide e-mail technical support.

E17.1.3 Provide self-service on-line support with the following:

- (a) Comprehensive access to the manufacturer's knowledge base with technical articles, tech notes, manuals, instructions, etc.
- (b) Downloads of the latest firmware updates and service patches for the programmable controller system components.

E17.2 Desired features:

E17.2.1 Telephone technical support:

- (a) Provide toll-free phone support
- (b) Provide 24 hour support, 7-days/week.
- (c) Provide a high level accessibility of technical support personnel.

E17.2.2 Provide direct access to manufacturer technical support personnel.

E17.3 For the Programmable Controller hardware proposed to meet the requirements of Programmable Controller System 1, as identified in E11, provide one year of support service, renewable annually. The support service must meet the requirements of E17.1.

E17.4 For the Programmable Controller hardware proposed to meet the requirements of Programmable Controller System 2, as identified in E12, provide one year of support service, renewable annually. The support service must meet the requirements of E17.1.

E17.5 For the Programmable Controller hardware proposed to meet the requirements of Programmable Controller System 3, as identified in E13, provide one year of support service, renewable annually. The support service must meet the requirements of E17.1.

E17.6 The support service shall be available to a minimum of ten (10) users.

- (a) Desired feature: Provide access to support services for an unlimited number of users within the City organization.

E17.7 The City may at its discretion choose whether to purchase or renew the support service for any given year on an annual basis. There shall be no additional charges or restrictions on future purchases of the service if the City chooses not to purchase the service for any number of years.

E18. PROGRAMMABLE CONTROLLER PROGRAMMING SOFTWARE ANNUAL UPDATE AND SUPPORT SERVICE

E18.1 The update service shall include the following:

E18.1.1 Software updates, at no additional charge, of the programmable controller programming software and all associated software tools included in the proposal.

E18.1.2 Major and minor updates shall be included.

E18.1.3 All patches and bug fixes shall be included and be made available for download.

E18.1.4 In the event that the programmable controller software included in the proposal is removed from active sale, an update to the next generation of applicable programming software shall be provided.

- E18.2 The support service shall include the following:
- E18.2.1 Provide telephone technical support, available from 8 am to 4 pm CST, Monday to Friday.
 - E18.2.2 Provide e-mail technical support.
 - E18.2.3 Provide self-service on-line support with the following:
 - (a) Comprehensive access to the manufacturer's knowledge base with technical articles, tech notes, manuals, instructions, etc.
 - (b) Downloads of the latest software updates and service patches for the programmable controller programming software and associated components.
- E18.3 Desired features:
- E18.3.1 Telephone technical support:
 - (a) Provide toll-free phone support
 - (b) Provide 24 hour support, 7-days/week.
 - (c) Provide a high level accessibility of technical support personnel.
 - E18.3.2 Provide direct access to manufacturer technical support personnel.
- E18.4 The support service shall, at minimum, be available to the same number of users as software licences purchased.
- (a) Desired feature:
 - (i) The technical support is accessible to an unlimited number of City users.
- E18.5 The City may at its discretion choose whether to purchase or renew the update and support service for any given year on an annual basis. There shall be no additional charges or restrictions on future purchases of the service if the City chooses not to purchase the service for any number of years.

E19. PROCESS SIMULATOR ANNUAL UPDATE AND SUPPORT SERVICE

- E19.1 The update service shall include the following:
- E19.1.1 Software updates, at no additional charge, of the process simulator software and all associated software tools included in the proposal.
 - E19.1.2 Major and minor updates shall be included.
 - E19.1.3 All patches and bug fixes shall be included and be made available for download.
 - E19.1.4 In the event that the process simulator software included in the proposal is removed from active sale, an update to the next generation of applicable process simulator software shall be provided.
- E19.2 The support service shall include the following:
- E19.2.1 Provide telephone technical support, available from 8 am to 4 pm CST, Monday to Friday.
 - E19.2.2 Provide e-mail technical support.
 - E19.2.3 Provide self-service on-line support with the following:
 - (a) Comprehensive access to the manufacturer's knowledge base with technical articles, tech notes, manuals, instructions, etc.
 - (b) Downloads of the latest software updates and service patches for the programmable controller programming software and associated components.
- E19.3 Desired features:
- E19.3.1 Telephone technical support:
 - (a) Provide toll-free phone support

- (b) Provide 24 hour support, 7-days/week.
- (c) Provide a high level accessibility of technical support personnel.

E19.3.2 Provide direct access to manufacturer technical support personnel.

E19.4 The support service shall, at minimum, be available to the same number of users as software licences purchased.

- (a) Desired feature:
 - (i) The technical support is accessible to an unlimited number of City users.

E19.5 The City may at its discretion choose whether to renew the update and support service for any given year on an annual basis.

E20. PROGRAMMABLE CONTROLLER LOCAL TRAINING SESSION

E20.1 Overview

E20.1.1 Provide instruction to designated City personnel in the operation and maintenance of the programmable controller control system and associated tools and equipment.

E20.2 Location

E20.2.1 The location of the training will be in the City of Winnipeg, in a facility provided by the City. The room will be classroom style.

E20.3 Submittals

E20.3.1 Submittals to be in accordance with E6.

E20.3.2 Submit the names and qualifications of the proposed instructors.

E20.3.3 Submit training proposal complete with hour by hour schedule including brief overview of content of each training segment a minimum of 30 working days prior to anticipated date of beginning of training.

E20.4 Quality Assurance

E20.4.1 Provide competent instructors thoroughly familiar with all aspects of the programmable controller control system.

E20.4.2 The Contract Administrator may reject instructors it deems to not be qualified.

E20.4.3 In the event that the training provided is not satisfactory, reduction of payment as per D18.6(a) may be applied.

E20.5 Duration

E20.5.1 The training shall be a minimum of five (5) hours in duration, excluding a coffee and lunch breaks.

E20.6 Materials

E20.6.1 Provide equipment, visual and audio aids, and materials.

E20.6.2 Supply manual for each trainee, describing in detail the information included in each training program.

E20.7 Attendees

E20.7.1 The attendees are expected to include, but not be limited to:

- (a) Electrical and instrumentation maintenance personnel.
- (b) Programmable controller support specialists.

E20.8 Content

E20.8.1 Overview of the equipment.

E20.8.2 Equipment maintenance training including:

- (a) Installation
- (b) Troubleshooting
- (c) Preventative maintenance
- (d) Replacement of modules
- (e) Network communication troubleshooting and diagnostics.
- (f) Fieldbus troubleshooting and diagnostics
- (g) Programmable controller redundancy strategies and operation.

E20.8.3 Maintenance use of programmable controller programming software, including:

- (a) Basic operation of the software
- (b) Connecting to programmable controllers
- (c) Download and upload of software configuration.
- (d) Diagnostics and troubleshooting.

E21. PROGRAMMABLE CONTROLLER SPECIALIST TRAINING

E21.1 Overview

E21.1.1 Provide specialized training courses to designated City personnel in the programming and maintenance of the programmable controller control system and associated tools and equipment.

E21.2 Location

E21.2.1 The location of the training will be in a Contractor supplied facility within North America.

E21.3 Submittals

E21.3.1 Submittals to be in accordance with E6.

E21.3.2 Submit the names and qualifications of the proposed instructors.

E21.3.3 Submit training proposal complete with hour by hour schedule including brief overview of content of each training segment a minimum of 30 working days prior to anticipated date of beginning of training.

E21.4 Quality Assurance

E21.4.1 Provide competent instructors thoroughly familiar with all aspects of the programmable controller system.

E21.4.2 The Contract Administrator may reject instructors it deems to not be qualified.

E21.4.3 In the event that the training provided is not satisfactory, reduction of payment as per D18.7(a) may be applied.

E21.5 Duration

E21.5.1 The duration of the training shall be part of the proposal, and shall consist of pre-packaged courses offered by the manufacturer. The expectation is a duration of approximately six (6) to eight (8) days.

E21.6 Attendees

E21.6.1 The attendees are expected to be programmable controller support specialists with programming expertise.

E21.7 Content

E21.7.1 Programmable Controller Programming Content – The training course attendee shall be able to perform the following upon the completion of training. Note that multiple courses may be required to achieve the below objectives.

- (a) Utilization of the programming and configuration software to configure a programmable controller system and associated I/O.
- (b) Basic programming using FBD, SFC, LD and ST as applicable to the software capabilities.
- (c) Implement derived functions blocks at the basic level.
- (d) Demonstrate an understanding of derived data types and their uses in a program.
- (e) Create, save, download, upload, test, monitor, search, and debug a programmable controller program.
- (f) Document and print a programmable controller program.
- (g) Configure a programmable controller.
- (h) Utilize security features.
- (i) Program in all software languages offered in the programming software.
- (j) Create and use derived function blocks.
- (k) Create and use Derived data types.
- (l) Export/Import programs
- (m) Configure and develop applications for redundant programmable controllers.

E21.7.2 Network Communication and Configuration – The training course attendee shall be able to perform the following upon the completion of training for the networks between programmable controllers, remote I/O networks, and fieldbus networks. Note that multiple courses may be required to achieve the below objectives.

- (a) Understand the principle of operation.
- (b) Troubleshooting and diagnostics of network communication.
- (c) Installation and extension of the network.
- (d) Understand network capacity, and determine the available capacity of network segments.
- (e) Maintain networks installed in hazardous locations.
- (f) Configuration of Ethernet switches, gateways, etc.

E22. HMI SYSTEM GENERAL REQUIREMENTS

E22.1 General

- (a) The HMI System shall provide software, licences, and all related components for the following:
 - (i) Redundant data servers to interface with the complete set of programmable controllers.
 - (ii) Redundant HMI Servers.
 - (iii) Redundant Terminal Servers, if a thin client architecture is proposed.
 - (iv) Operator workstations.
 - (v) HMI Web Servers
 - (vi) Portable Operator Device software
 - (vii) Include other software and licences as required to implement the specified functionality. This includes any databases (i.e. SQL Server), web servers (i.e. Internet Information Server), etc. along with all licences to meet the specified functionality.

E22.2 Work by Others

- (a) Supply of the computer server and desktop hardware.
- (b) Supply of virtualization software, other than any specific software that is required by the manufacturer to support virtualization.
- (c) Networking.
- (d) Base Microsoft Windows operating system for workstations or servers.

E22.3 Submittals:

- (a) Make submittals in accordance with E6.
- (b) Submit comprehensive datasheets showing all part numbers where applicable.
- (c) Manufacturer's standard installation and operating instructions.
- (d) Recommended computer hardware.

E22.4 The overall HMI software package shall meet the following requirements:

E22.4.1 Client Server Architecture:

- (a) Utilize a client-server architecture with two HMI servers in a redundant configuration for each HMI system.

E22.4.2 Integrated Multi-Facility System

- (a) Provide the capability that any Operator Workstation may be temporarily utilized to view and control any of the three wastewater treatment facilities, provided appropriate credentials are utilized.
- (b) Provide the capability for permanent Operator Workstations at the NEWPCC facility to monitor and control the SEWPCC and WEWPCC facilities.
- (c) Each wastewater treatment facility shall be capable of operating autonomously, with no loss of any local features in the event of an inter-facility network failure.

E22.4.3 Portable HMI Client Access

- (a) Allow read/write access to each facility HMI system via a generic portable device such as a smartphone / tablet.

E22.4.4 Redundancy

- (a) Redundant servers shall be provided for all server functions such that there is no loss of monitoring, control, or historical data upon any single server failure, except as noted below.
- (b) The software shall fully support redundant networking systems.

E22.5 Operator Workstation Requirements

E22.5.1 Option 1 – Thick Clients

- (a) Operator workstations based upon thick clients will utilize proprietary software loaded onto a Microsoft Windows computer to provide the operator interface. The thick client software will communicate directly with the HMI Servers.
- (b) Provide the ability to automatically switch between the redundant HMI Servers.
- (c) Provide the ability to monitor and control any of the three wastewater treatment facilities from any other facility. It is desired that this capability be provided through the standard thick clients, and if not, must be provided by some other means.

E22.5.2 Option 2 – Thin Clients

- (a) Operator workstations based upon thin clients will utilize standard terminal services software loaded on a thin client to view a client session on a terminal server.
- (b) Redundant terminal servers must be provided for each wastewater treatment facility.
- (c) Provide the ability to automatically switch between the redundant terminal servers.

- (d) Provide the ability to monitor and control any of the three wastewater treatment facilities from any other facility. It is desired that this capability be provided through the standard thin clients, and if not, must be provided by some other means.

E22.5.3 Desired Features:

- (a) Preference will be given to thin-client operator workstations; however Bidders are encouraged to submit their recommended architecture solution.
- (b) Preference will be given to systems where the operator workstation can easily connect to a different facility's HMI Servers to monitor and control the other facility.

E22.6 Operating System

- (a) The software shall run on current generation Microsoft Windows operating systems.

E22.7 Portable Operator Device Requirements

E22.7.1 Provide the capability for comprehensive HMI access via portable operator devices such as tablets and smartphones.

E22.7.2 Option 1 – Terminal Server Client Interface

- (a) Portable operator device based upon terminal server clients will utilize industry standard terminal services software loaded on the mobile device view a client session on a terminal server.
- (b) Redundant terminal servers are only required if the terminal servers are also utilized for the HMI servers.

E22.7.3 Option 2 – Web Client

- (a) Portable operator device based upon a standard web browser interface loaded on the mobile device to view a HMI session. The web interface will allow for read/write access.
- (b) A web server must be located within each facility under this proposed architecture. The communication for portable operator devices shall not be required to leave the facility.

E22.7.4 Desired Features:

- (a) Preference will be given to portable devices utilizing a terminal services architecture; however Bidders are encouraged to submit their recommended architecture solution.
- (b) Preference will be given to server based pool licensing systems.
- (c) Preference will be given to systems that can provide effective alarm notification, without requiring the operator to be actively engaging the portable HMI.

E22.8 Virtualization

- (a) Architectures that utilize server virtualization are of interest to the City, but no decision will be made until the RFP is awarded. The Bidder shall identify tested software capabilities with regards to server virtualization, and indicate approved and recommended architectures.

(a) Desired features:

- (i) Provide documented and tested server software capabilities, with regards to server virtualization.

- (b) Server virtualization software is not included in this RFP.

E22.9 References:

- (a) OPC Foundation.
 - (a) OPC UA Part 8 – Data Access RC 1.01.10 Specification.
 - (b) OPC DA 3.00 Specification.
 - (c) OPC DA 2.05a Specification.

E22.10 General Requirements:

- (a) Provide a minimum number of HMI Software CDs / DVDs equal to the number of licences.
- (b) Size / Capability Requirements:
 - (a) Provide software with capability to allow doubling of the size of the application laid out in this specification.

E22.11 Licence Requirements:

- (a) Licences that expire will not be accepted.

E22.12 Design Requirements:

- (a) HMI is not to form part of real time control functions either directly or indirectly or as part of communication link. Real time control functions to reside in the programmable controllers with peer to peer communication as required.
- (b) If display of a controller failure is dependent upon communication or operation of a processor, utilize watchdogs programmed into the HMI to provide controller failure alarming.

E22.13 Data Access Requirements:

- (a) Meets OPC DA 2.05 Specification or OPC DA 3.00 Specification (OPC Data Access) for Client Support.
- (b) Desired Feature:
 - (a) Meets OPC DA 2.05 Specification or OPC DA 3.00 Specification (OPC Data Access) for Server Support.
 - (b) Meets OPC UA Part 8 – Data Access RC 1.01.10 Specification for Client Support.
 - (c) Meets OPC UA Part 8 – Data Access RC 1.01.10 Specification for Server Support.

E22.14 System Performance Requirements:

- (a) Response time:
 - (a) The response time measurement is to be from the time of I/O actuation to the HMI OWS display, or vice versa.
 - (b) Maximum: 2 seconds

E22.15 Operator Workstation Displays:

- (a) Operator Workstation to operate using a GUI (graphical user interface) where a pointing device (mouse), and a keyboard are used to control the interaction of the user with the information on the display screen.
- (b) Organise the operator display through the use of a multi-pane display system, such as Windows™. Display formats to be uniform throughout the system.
- (c) Operator workstation features to be the standard features provided by the manufacturer. Custom features to be limited to that functionality which is intended to be individualised by all users. Individualised features to be configured via the standard programming and development tools that are standard to the manufacturer's product. Use of 3rd party software to be approved by the Contract Administrator.
- (d) Support an implementation philosophy where all interactions with and display of similar information are the same.
- (e) Utilize an area of each display screen to display summary information including status of the Control System, the system time and a alarm summary information. Do not overwrite this area any other display function.
- (f) Integrate alarm and historian functions seamlessly with the display functions.
- (g) Provide a uniform display symbol for the event where data is not available.

- (h) Prevent display windows from being collapsed or moved off the screen, so as to be lost to the user.
- (i) Process Graphics:
 - (a) Provide capability to display any data via their tagname, parameter reference, including system parameters such as time and date.
 - (b) Provide capability to use basic graphics objects that change colour, size, location, rotation, and visibility based on the underlying tag values.
 - (c) Basic graphic objects: points, straight lines, polylines, curved lines, rectangles, rounded rectangles, ellipses, arcs, bar graphs, gauges, pie charts, scales.
 - (d) Advanced graphic objects: radio buttons, check boxes, list objects, formatted numeric display fields, formatted numeric entry fields, string fields, pushbuttons, alarm banners, alarm summary, trends.
 - (e) Support a hierarchical display design system where information is presented in successive layers of detail.
 - (f) Accessible library of pre-configured graphic objects such as tanks, valves, motors, pipes, and pumps.
- (j) Faceplates for control loops:
 - (a) Pop-up (floating) faceplates for all control loops showing:
 - (i) Setpoint (SP)
 - (ii) Process Value (PV)
 - (iii) Control Value (CV)
 - (iv) Auto / Manual Status
 - (b) Facilitate ability for operator to take manual control of the loop.
- (k) Embedded images:
 - (a) Support embedding of images into graphic displays of the following formats:
 - (i) JPEG,
 - (ii) BMP,
 - (iii) GIF,
 - (iv) PNG.
- (l) Desired Features:
 - (a) Support ability to utilize parameters or tag placeholders rather than tagnames on graphic displays to allow for reuse of same display for multiple similar pieces of equipment.

E22.16 Expressions

E22.16.1 Expressions shall have the ability to be used, as a minimum, in any one of the following:

- (a) Graphic displays,
- (b) Alarm setup,
- (c) Macros.

E22.16.2 Expressions shall have the ability to be built from, as a minimum:

- (a) Tag values,
- (b) Constants,
- (c) Mathematical, relational, and logical operators.
- (d) Built-in functions.
- (e) If-Then-Else logic.

E22.16.3 The expression editor shall have the ability to use, as a minimum, the following arithmetic operators: addition, subtraction, multiplication, division, modulus, and exponent.

- E22.16.4 The expression editor shall have the ability to use, as a minimum, the following relational operators: equal, not equal, less than, greater than, less than or equal to, and greater than or equal to.
- E22.16.5 The expression editor shall have the ability to use, as a minimum, the following logical operators: AND, OR, and negation.
- E22.16.6 A command wizard shall facilitate creating actions that trigger when the expression evaluates true.
- E22.17 Alarming
- E22.17.1 General Requirements
- (a) Consider alarm occurrences as events.
 - (b) Reference application tagnames, their parameters and the time clock.
 - (c) Integrate alarm system as an integral part of the HMI functionality.
 - (d) Time stamp an alarm event occurrence to within a second of the system wide time clock.
 - (e) Provide universal, uniform alarm information throughout the Control System, including all operator workstations and the Historian.
 - (f) Record all alarm changes, including occurrence, acknowledgement, return to normal, inhibits, enables and changes to parameters, within the Historian.
 - (g) Provide visual and audible alarm notification.
- E22.17.2 Software to notify operator of each occurrence of alarm conditions. Each point to have its own alarm message.
- E22.17.3 Primary alarm message to include as minimum: point identifier, alarm classification, time of occurrence, type of alarm, description/message.
- E22.17.4 Acknowledgement of alarm to change visual indicator colour and to silence audible device. Acknowledgment of alarm to be time, date and operator stamped and logged. Alarm indicator to remain until alarm condition is corrected but must not impede reporting of new alarm conditions. Do not allow acknowledgment of one alarm as acknowledgement of other alarms.
- E22.17.5 In the alarm summary display, a user can acknowledge an alarm. The alarm will then appear as acknowledged to all clients in the application.
- E22.17.6 Controller network alarms: system supervision of controllers and communications lines to provide the following alarms at minimum:
- (a) Controller not responding: where possible delineate between controller and communication line failure.
 - (b) Controller responding: return to normal.
 - (c) Controller communications bad: high error rate or loss of communication.
 - (d) Controller communications normal: return to normal.
- E22.17.7 Alarm configuration requirements:
- (a) Define the primary alarm parameters of analog-based alarms in the controller database.
 - (b) Provide a minimum of three alarm priority levels.
 - (c) Support discrete alarms on any discrete tag, with two distinct states, normal and alarm, individually assignable to alarm on either low or high value.
 - (d) Support state variable alarms, where each possible state of the tag may be designated as an alarm and assigned an independent priority.

- (e) Support analog alarms on any analog tag, with absolute alarming (HH, H, L, LL), deviation alarming (with reference to controller setpoint or an alarm reference point) and rate of change alarming, each with a different priority, each with a different deadband.
- (f) Utilize a standard set of parameters that can also be used in operator graphics: time stamp, value or state name, alarm limit, engineering units, tagname, alarm type, alarm descriptor, priority, process area, associated alarm, acknowledgement status.
- (g) The alarm system shall allow the operator to call a command or macro when an alarm in the summary is selected.
- (h) Provide means for an operator, with appropriate security level, to disable or inhibit an alarm. Provide a means to view all disabled / inhibited alarms.
- (i) Provide alarm grouping that allows alarms to be grouped by process area and to allow use of alarm group statistics, such number of active alarms, as values for display on process graphics.

E22.17.8 Alarm annunciation requirements:

- (a) Integrated with the HMI software functionality.
- (b) Annunciate in a uniform manner through the HMI display screens.
- (c) Annunciate process, safety, system diagnostics ("bad" tag) and equipment status alarms.
- (d) Annunciate unacknowledged alarm occurrence and reoccurrence.
- (e) Support a uniform operator procedure for horn silence, alarm display and alarm acknowledge.
- (f) Respond predictably with uniform colour response on graphics, with horn volume based on alarm priority, alarm status and acknowledgement status.
- (g) Provide alarm acknowledge functionality selective by tag and by what is visible on an alarm display.
- (h) Alarm acknowledgement is to be universal across the HMI system.
- (i) Standard operator alarm display requirements:
 - (i) Display active and unacknowledged alarms, filtered by time, history, priority, process partition or acknowledgement status, as selected by the operator,
 - (ii) Display counts of the number of alarms,
 - (iii) Support navigation "hot link" between an alarm displayed in the alarm summary window and an associated process graphic.

E22.17.9 Alarm reports:

- (a) Support the reporting of alarms on reports through the Historian.
- (b) Provide for time-based sorts of past alarm information.
- (c) Provide for display of the alarm history of an individual tag, incident group or a process group of alarms on operator demand.
- (d) Summary of points in critical, cautionary or maintenance alarm. Include at least point name, alarm type, current value, limit exceeded.
- (e) Analog alarm limit summary: include point name, alarm limits, deviation limits.
- (f) Summary of alarm messages: include associated point name, alarm description.

E22.18 Event Logging / Audit Trail:

- (a) Log the following events to an event log:
 - (i) Operator log in from user interface device.
 - (ii) Communication messages: errors, failures and recovery.
 - (iii) Event notifications and alarms by category.
 - (iv) Record of operator initiated commands.

- (b) Store the event log in a secure location and do not allow editing of the file.
- (c) Maintain a minimum of one year of information and be readily accessible to operator.
- (d) Provide for archival of the event log to a writable CD-ROM or DVD-ROM.
- (e) When data is logged to the secure database, include:
 - (i) A timestamp.
 - (ii) Node identifier.
 - (iii) Current logged in user's security identifier or username (if username is unique between users).
 - (iv) A description of user action and user entered command or data.
- (f) Provide reports to display the audit trail:
 - (i) User logins, logouts.
 - (ii) System start-up, shutdown commands.
 - (iii) Alarm controls.
 - (iv) Single devices controls.
 - (v) Setpoint changes.
 - (vi) Parameter changes.
 - (vii) Operational mode changes.
 - (viii) Sequence controls.
 - (ix) Administration commands.
- (g) Desired Feature:
 - (i) Provide the capability to insert real-time, user edited comments into the event log.

E22.19 User Access/Security Level Requirements:

- (a) Utilize password protection to limit specific user operation.
- (b) Permit viewing of operator displays only with appropriate user logon.
- (c) Provide a minimum of ten (10) levels of password access protection to limit control, display, or data base manipulation capabilities.
- (d) Provide user definable, automatic log off timers from 1 to 60 min. to prevent operators leaving devices on line inadvertently. Provide means of disabling automatic log-off timer.
- (e) Provide capability for a minimum of one hundred (100) distinct accounts for each user access level. At each level, all user environments for each account to be identical.

E22.20 Trending

- (a) Includes historical data collection utility, trend data utility, control loop plot utility. Each utility to permit operator to add trend point, delete trend point, set scan rate.
- (b) Trend data utility: continuously data variables for variables as selected by operator, including at minimum; present value of following point object types DI, DO, AI, AO set points value, calculated values. Control loop plot utility: for AO points provide for concurrent plotting of process value input (PV), control output value (CV), and setpoint (SP). Operator selectable sampling interval to be selectable between 1 second to 20 seconds. Plotting utility to scroll to left as plot reaches right side of display window. Systems not supporting control loop plot as separate function must provide predefined groups of values. Each group to include values for one control loop display.

E22.21 Linkages

- E22.21.1 Provide means to link to external documents, such as operator manuals, from the control system HMI.

E22.22 Libraries

E22.22.1 Supply all available libraries, for use by the City, that are applicable for use as part of the wastewater treatment system upgrades, including but not limited to:

- (a) Graphic object libraries
- (b) Control function blocks
- (c) Data templates
- (d) Pre-built reports

E22.23 Redundancy

- (a) The HMI system shall be provided with redundant HMI servers and redundant data (I/O) servers.
- (b) The HMI redundancy shall be provided without the need to write application logic.
- (c) The HMI shall support fail over from a primary server to a secondary server.
- (d) The HMI shall support fail back from a secondary server to a primary server.
- (e) The HMI shall support the ability to run an event on failover.
- (f) The HMI shall support a controlled, manual switchover from the active server to the standby server and vice versa.
- (g) The HMI shall support the ability to run an event on failback. The HMI shall automatically synchronize the alarm state information on the primary and secondary so there is no disruption or loss of alarm state information on a failover.
- (h) Failure of a single computer or software component will not interrupt any feature of the software, with the exception of the Historian.
- (i) Operating or historical data loss will not occur due to the transfer to the redundant server computer, or the restoration to the primary server.
- (j) Transfer from the primary to redundant system to not cause an interruption greater than 10 seconds for workstation users.
- (k) Where built in software logic is not able to detect failure modes within a reasonable duration, specific, well documented software logic is to be written to provide the required redundancy capability.
- (l) Appropriate notification of failure event and redundancy operation to be provided on the Operator Workstations.
- (m) Desired features:
 - (i) Support automatic replication of HMI application changes made to the primary HMI server to the secondary HMI server.
 - (ii) Support for "Favour Current" and "Favour Primary" configuration options to provide choices of HMI Server failback. In the "Favour Current" option the system shall continue using the secondary server when the primary becomes available. In the "Favour Primary" option the system shall automatically switch from the active secondary server to the primary when it becomes available.

E22.24 Time Synchronization:

- (a) System to provide Time Synchronization of real time clocks in controllers.
- (b) System to perform this feature on regular scheduled basis and on operator request.

E22.25 Control Loop Override:

- (a) According to assigned user privileges (password definition) following functions are to be supported:
 - (i) Permit operator to terminate automatic (logic based) control and set value of field point to operator selected value. These values or settings to remain in effect until returned to automatic (logic based) control by operator.

E22.26 Desired features:

E22.26.1 Parameterization:

- (a) Support for tag placeholders or parameters in place of tag names to facilitate re-use of same graphic display or objects for multiple similar piece of equipment.

E22.26.2 Object Oriented Capabilities:

(a) Data

- (i) Custom data object classes may be created and stored in a central repository.
- (ii) Centralized data object classes may be utilized to create specific data object instances
- (iii) Modification of the central object data class will automatically be propagated to all object instances that were created.

(b) Graphics

- (i) Custom graphic object classes may be created and stored in a central repository.
- (ii) Centralized graphic object classes may be utilized to create specific graphic object instances
- (iii) Modification of the central graphic object class will automatically be propagated to all graphic object instances that were created.

(c) Integration

- (i) The data objects and graphic objects are inherently linked.

E23. HMI SERVER SYSTEM SOFTWARE – FACILITY

E23.1 Overview

- (a) Provide a comprehensive set of Human Machine Interface (HMI) server software, required for each wastewater treatment facility.

E23.2 The software requirements for each wastewater treatment facility are dependent upon the Bidder's proposal, and shall be developed to meet the overall requirements identified in E22. Each system to include, but not be limited to the following:

- (a) Redundant HMI Server Software
- (b) Redundant I/O Servers
- (c) If thin clients are proposed, redundant Terminal Server Software, to allow the use of thin clients within the facility.

E23.3 Licence requirements

E23.3.1 Server licences are to be sufficient for the proposed application, plus 100% spare.

E23.3.2 Assume the following as minimum requirements for licensing:

(a) Display-based licensing

- (i) NEWPCC: 600 displays
- (ii) SEWPCC: 400 displays
- (iii) WEPCC: 350 displays

(b) Point based licensing whereby licence is based upon points read from controller, excluding alarms

- (i) NEWPCC: 50,000 points
- (ii) SEWPCC: 30,000 points
- (iii) WEPCC: 25,000 points

- (c) Point based licensing whereby licence is based upon points read from controller, including alarms
 - (i) NEWPCC: 100,000 points
 - (ii) SEWPCC: 60,000 points
 - (iii) WEWPCC: 50,000 points

E23.3.3 Desired feature:

- (a) Preference will be given to unlimited licences.

E23.4 The proposal shall identify server computer hardware requirements; however the physical computer hardware is not included in the proposal.

E23.5 The proposal shall identify Windows server operating system requirements; however the operating system software is not included in the proposal. However, all other software licences are to be included.

E24. HMI OPERATOR WORKSTATION SOFTWARE / LICENCE

E24.1 Architecture:

- (a) Option 1 – Thin Clients, per E22.5.2.
 - (i) Thin clients are preferred.
- (b) Option 2 – Thick Clients, per E22.5.1.

E24.2 Requirements:

- (a) Software to provide operator (client) access to the local facility's redundant HMI servers from a desktop PC-compatible workstation running the Microsoft Windows operating system.
- (b) Ability to manually select between either of the local facility's redundant HMI servers.
- (c) Facilitate real-time view and control of the process including alarming.
- (d) Supports secure user login to the HMI server to facilitate control.
- (e) Run-time client licence does not expire.

E24.3 Desired features:

- (a) Floating, server-based licences.
- (b) Software provides the capability for clients to easily access any of the three wastewater treatment facilities for both read and control functions via the corporate wide area network.

E25. PORTABLE HMI CLIENT SOFTWARE / LICENCE

E25.1 Architecture:

- (a) Option 1 – Terminal Services (Remote Desktop) Clients, per E22.7.2.
- (b) Option 2 – Web Clients, per E22.7.3.

E25.2 Requirements:

- (a) Software to provide the capability for comprehensive HMI access via portable operator devices such as tablets and smartphones.
- (b) The portable HMI client software / licence shall be capable of view and control.
- (c) Support secure user login to the HMI server to facilitate control.
- (d) Provides the capability for portable client access to any of the three wastewater treatment facilities via the internet.
- (e) Compatible with Apple iPhone iOS version 6 and higher, and Android version 4.1 and higher.

- (f) Run-time client licences never expire.
- (g) Indicate 3rd party software requirements (e.g. mobile terminal services client software) as applicable.

E25.3 Desired features:

- (a) Floating, server-based licences.

E26. HMI WEB SERVER SYSTEM

E26.1 Overview:

- (a) Provide web-based view-only access to the complete HMI functionality. The interface shall be via a standard web browser without the need for the HMI client software.
 - (i) Desired Feature: Provide read/write access based upon the web login credentials.

E26.2 Desired Architecture:

- (a) Provide a HMI web server per facility (preferred).
- (b) A centralized HMI web server will be accepted, provided:
 - (i) There is no loss in functionality
 - (ii) The local portable HMI client system is not dependent upon the proposed central web server.
- (c) Redundancy shall not be required for:
 - (i) HMI Web Server

E26.3 Web Server Client Licences

- (a) Provide a minimum number of floating web client licences as follows:
 - (i) NEWPCC: 5 simultaneous clients
 - (ii) SEWPCC: 3 simultaneous clients
 - (iii) WEPCC: 3 simultaneous clients
- (b) If proposing a centralized server system, the total number of simultaneous clients shall be the sum of that specified for the individual facilities.
- (c) In the event that the portable HMI client system is proposed to be based upon the web servers located in the facility, the portable HMI client licences shall be in addition to those specified.
- (d) Server and web client licences shall never expire.
- (e) All licences shall be floating and not tied to a specific client.

E26.4 Requirements include but are not limited to:

- (a) HMI web server to facilitate display of HMI system application on client PCs via a web-browser.
- (b) Provide read-only, remote access to the complete HMI system application including HMI displays, equipment faceplates (pop-ups), trends, and alarms.
 - (i) The display of the web graphics shall be automatic and require no manual modification, regeneration, or configuration of individual graphics or pages.
- (c) Facilitate real-time display of HMI object animation and process values on client device.
- (d) HMI web server to provide access to the identical HMI application(s) utilized by the plant's main redundant HMI servers. Requirement for development and use of a separate HMI application solely for the HMI web server is not acceptable.
- (e) Remote access to HMI web server system shall not require the installation of HMI client software or access licences on the client devices.

- (f) Security:
 - (i) Access to HMI web server granted only by way of secure user login. Allow for individual assignment of access rights to users.

E26.5 Desired features:

- (a) Configurable automatic display scaling.
- (b) Support for mobile browsers:
 - (i) Apple Safari
 - (ii) Google Chrome
- (c) Configurable automatic time-out and logoff of idle client devices.
- (d) No requirement for the installation of 3rd party browser plugins on client devices.

E27. HMI AND HISTORIAN PROGRAMMING SOFTWARE

E27.1 The HMI and Historian Programming Software shall be comprised of all software and licences to program, maintain, and support the complete feature set of the HMI and Historian proposed. All additional software components shall be included in this price, if the additional component in any way relates to this RFP or the proposal submitted.

E28. HISTORIAN GENERAL REQUIREMENTS

E28.1 General

- (a) Provide a comprehensive historian system for the NEWPCC, SEWPCC and WEWPCC facilities that captures, stores, and presents historical data from the control system.
- (b) The historian shall be configured in a manner to prevent the loss of any historical data upon failure. No gaps in data gathering shall occur.
 - (i) Assume that the data connections between sites could be unavailable for seven (7) days.
 - (ii) Assume that each individual historian server could be out of service for four (4) days.
- (c) Desired architecture:
 - (i) Each facility will be provided with a dedicated local historian server.
 - (ii) Redundant data servers will be provided with buffering capability in the event of historian failure.
 - (iii) A non-mandatory central archive server will replicate the data on the local historian servers to provide long term data storage and enterprise data access.

E28.2 Requirements

- (a) The historian shall log all process values, alarms and events.
- (b) Data collection not to interfere with any other Control System function.
- (c) Data stored with time stamp.
- (d) The historian shall be scalable and expandable.
- (e) Capable of specifying method of polling for each tag or tag group: periodic with specified interval, or upon threshold change of value.

E29. HISTORIAN SERVER SOFTWARE

E29.1 Requirements include, but are not limited to:

- (a) Software for use on servers running the Windows Server 2008 or newer operating system.

E29.2 General

- (a) The historian software shall comply with E28.

(b) The historian facility server software shall be provided for each facility to gather and store historical data.

(c) The historian shall be a similar product to the proposed central historian.

E29.3 Submittals

(a) Provide details regarding all server hardware requirements, including but not limited to:

- (i) processor speed and type,
- (ii) speed, type, and quantity of RAM,
- (iii) network adapter(s), and
- (iv) hard drive speed, size, type, and configuration (eg. RAID 10).

E29.4 Data Requirements

E29.4.1 NEWPCC

- (a) Provide sufficient capability and licensing to store:
- (i) Minimum 20,000 analog and discrete data points
 - (ii) Alarms and events shall not require a tag licence.

E29.4.2 SEWPCC

- (a) Provide sufficient capability and licensing to store:
- (i) 10,000 analog and discrete data points
 - (ii) Alarms and events shall not require a tag licence.

E29.4.3 WEWPCC

- (a) Provide sufficient capability and licensing to store:
- (i) Minimum 5,000 analog and discrete data points
 - (ii) Alarms and events shall not require a tag licence.

E29.5 Software Requirements

(a) Provide all database software and associated licences.

E30. HISTORIAN CLIENT SOFTWARE / LICENCE

E30.1 General

- (a) Provide access to historical data from any of the three (3) Historian Facility Servers or the Historian Central Archive Server.
- (b) Queries of the historical data may be generated in an ad hoc fashion.
- (c) Integration with Microsoft Excel is required, such that a user-friendly interface is provided to retrieve historical data into a worksheet.
- (d) Provide the ability to save and update queries at a later time.
- (e) Reports
 - (a) Provide the ability to extract data into format templates for display, printing, or saving to a file.
 - (b) Include standard templates and the ability to customise these and to create new report templates.
 - (c) Provide regularly scheduled reports, for one time or for the same daily, shift, weekly and monthly time.
 - (d) Provide on demand reports.

E30.2 Desired Features:

- (a) Provide data sampling, such that the reported data may represent only samples within a time period.

- (b) Provide a client application, not dependent upon Microsoft Excel to perform queries and trending / graphing / charting.
- (c) Provide a means to generate queries without any required SQL knowledge.
- (d) Provide a means to prepare a custom report utilizing historical data. Reports can be saved and regenerated on a periodic basis.

E30.3 Licence Requirements

E30.3.1 Provide all associated licences for both the server and client to allow for the following access.

- (a) Access from all HMI Servers / Operator Workstations, without using a licence indicated. If a historian access licence is required for the HMI Servers / Operator Workstations, it shall be provided in addition to the specific quantity of licences.
- (b) NEWPCC Historian
 - (i) Access for ten (10) floating pool users or twenty (20) fixed named users.
- (c) SEWPCC Historian
 - (i) Access for five (5) floating pool users or ten (10) fixed named users.
- (d) WEWPCC Historian
 - (i) Access for five (5) floating pool users or ten (10) fixed named users.

E30.3.2 In the event that a central historian is proposed, provide all associated licences for both the server and client to allow for the following access.

- (a) Access from all HMI Servers / Operator Workstations, without using a licence indicated. If a historian access licence is required for the HMI Servers / Operator Workstations, it shall be provided in addition to the specific quantity of licences.
- (b) Central Historian
 - (i) Access for fifteen (15) floating pool users or thirty (30) fixed named users.

E30.3.3 Desired feature:

- (a) Access for an unlimited number of users to all historians.
- (b) Floating pool licences are preferred over fixed named user licences.

E31. TOUCHSCREEN HMI

E31.1 General

- (a) The proposed touchscreen shall have an integrated stand-alone HMI package that shall directly communicate with one or more programmable controllers.

E31.2 Hardware Requirements

- (a) Screen:
 - (i) Type: Backlit colour TFT LCD
 - (ii) Size, minimum: 305 mm (12")
 - (iii) Colours, minimum: 65,536
 - (iv) Resolution, minimum: 800x600
 - (v) Touch sensitive.
- (b) Power Supply: 24 VDC.
- (c) Memory:
 - (i) Internal: solid-state storage for user application, minimum: 32 MB
 - (ii) External (removable): Secure Digital (SD) or Compact Flash card.

- (d) External Interfaces:
 - (i) Ethernet, 100 Mbit, TCP/IP and protocol compatible with the proposed programmable controller systems.
 - (ii) USB 2.0
- (e) Construction:
 - (i) No internal moving parts, including rotating-platter hard drives or fans.
 - (ii) Enclosure Rating (for front panel of installed unit): NEMA 12
 - (iii) Desired Feature:
 - (i) Provide NEMA 4X enclosure rating.
- (f) Mounting:
 - (i) Panel cut-out.
 - (ii) Orientation: landscape.
- (g) Environmental:
 - (i) Operating temperature range, minimum: 0-40 °C
 - (ii) Operating relative humidity range, minimum: 5-95% (non-condensing)
- (h) Approvals:
 - (i) CSA, or
 - (ii) c-UL-us

E31.3 Operational Requirements:

- (a) Update rate:
 - (i) Tag data updated on screen once every second.

E31.4 Desired Features:

- (a) Screen size availability:
 - (i) Provide options for a variety of screen sizes.
- (b) Power supply availability:
 - (i) 120 VAC, 60 Hz
 - (ii) Available conformal coating.
- (c) Dimmable Backlight.
- (d) Touchscreen calibration.

E32. TOUCHSCREEN HMI PROGRAMMING SOFTWARE

E32.1 Development Licence:

- (a) One user, floating, available for use on any networked computer with the touchscreen HMI programming software and access to the licence server. Licences locked to a specific PC based on hardware serial numbers, MAC addresses, or other means will not be accepted.
- (b) Licence does not expire.
- (c) Licence shall not impose limits on the number of graphic displays or tags that may be utilized within the application.

E32.2 Runtime Licence:

- (a) One licence as required per touchscreen HMI.
- (b) Licence does not expire.
- (c) Licence shall not impose limits on the number of graphic displays or tags that may be utilized within the application.

E32.3 Simulation:

- (a) Includes simulation of the HMI in software on the development PC.

E32.4 Graphic Capabilities:

(a) Standard Features:

- (i) Graphic displays: full screen, or pop-up (floating) windows.
- (ii) Basic graphic objects: points, straight lines, polylines, curved lines, rectangles, rounded rectangles, ellipses, arcs, bar graphs, gauges, pie charts, scales.
- (iii) Advanced graphic objects: radio buttons, check boxes, list objects, formatted numeric display fields, formatted numeric entry fields, string fields, pushbuttons, alarm banners, alarm summary, trends.
- (iv) Graphic object animation: change of colour, fill, position, rotation, size, and visibility based on tag value.
- (v) Accessible library of pre-configured graphic objects such as tanks, valves, motors, pipes, and pumps.

(b) Advanced Features:

- (i) Image display (jpeg, bmp, and png files),
- (ii) Zoom in/out on trends for detailed analysis,
- (iii) Alarm summary object complete with customizable alarm state colouring, for viewing active and historical alarms.

E32.5 User-defined scripts / macros:

- (a) Customizable scripts or macros based upon a standard accepted industry programming language such as JavaScript or BASIC.
- (b) Scripts / macros are capable of being triggered automatically by tag value, application start-up, application shut-down, opening of graphic display, user login, user logout, or manually via operator initiation.
- (c) Scripts / macros capable of opening and closing graphic displays, modifying tag data, and triggering historical data log.

E32.6 User-security:

- (a) Configurable user security with at minimum 10 user accounts.
- (b) Capability to apply user security to graphic displays and display objects.

E32.7 Programmable Controller Tag Support:

- (a) Support for user-defined data types (tag structures).

E32.8 Operating system compatibility:

- (a) Microsoft Windows 7

E32.9 Desired features:

- (a) Parameterization:
 - (i) Support for tag placeholders or parameters in place of tag names to facilitate re-use of same graphic display or objects for multiple similar piece of equipment.

E33. HMI, WEB SERVER AND HISTORIAN SYSTEM SOFTWARE - ANNUAL UPDATE AND SUPPORT SERVICE

E33.1 Overview:

- (a) Software updates, at no additional charge, of the HMI server, HMI client, HMI web server, Historian Server, Historian Client, Touchscreen HMI programming software, and all associated software tools included in the proposal.

- (b) Applicable to the central HMI and historian systems, as well as the three (3) facility HMI and historian systems.
- (c) Major and minor updates shall be included.
- (d) All patches and bug fixes shall be included and be made available for download.
- (e) In the event that the software(s) included in the proposal is removed from active sale, an update to the next generation of applicable software(s) shall be provided.

E33.2 The support service shall include the following:

- (a) Provide telephone technical support, available from 8 am to 4 pm CST, Monday to Friday.
- (b) Provide e-mail technical support.
- (c) Provide self-service on-line support with the following:
 - (i) Comprehensive access to the manufacturer's knowledge base with technical articles, tech notes, manuals, instructions, etc.
 - (ii) Downloads of the latest software updates and service patches for the programmable controller programming software and associated components.

E33.3 Desired features:

- (a) Telephone technical support:
 - (i) Provide toll-free phone support
 - (ii) Provide 24 hour support, 7-days/week.
 - (iii) Provide a high level accessibility of technical support personnel.
- (b) Provide direct access to manufacturer technical support personnel.
- (c) The technical support is accessible to an unlimited number of City users.

E33.4 Desired features:

E33.4.1 Telephone technical support:

- (a) Provide toll-free phone support
- (b) Provide 24 hour support, 7-days/week.
- (c) Provide a high level accessibility of technical support personnel.

E33.4.2 Provide direct access to manufacturer technical support personnel.

E33.5 The support service shall, at minimum, be available to the same number of users as software licences purchased.

- (a) Desired feature:
 - (i) The technical support is accessible to an unlimited number of City users.

E33.6 The City may at its discretion choose whether to purchase or renew the update and support service for any given year on an annual basis. There shall be no additional charges or restrictions on future purchases of the service if the City chooses not to purchase the service for any number of years.

E34. HMI AND HISTORIAN SPECIALIST TRAINING

E34.1 Overview:

E34.1.1 Provide specialized training courses to designated City personnel in the programming and maintenance of the HMI and Historian systems and associated tools and equipment.

E34.2 Location:

E34.2.1 The location of the training will be in a Contractor supplied facility within North America.

E34.3 Submittals:

E34.3.1 Submittals to be in accordance with E6.

E34.3.2 Submit the names and qualifications of the proposed instructors.

E34.3.3 Submit training proposal complete with hour by hour schedule including brief overview of content of each training segment a minimum of 30 working days prior to anticipated date of beginning of training.

E34.4 Quality Assurance:

E34.4.1 Provide competent instructors thoroughly familiar with all aspects of the HMI and Historian systems.

E34.4.2 The Contract Administrator may reject instructors it deems to not be qualified.

E34.4.3 In the event that the training provided is not satisfactory, reduction of payment as per D18.13(a) may be applied.

E34.5 Duration:

E34.5.1 The duration of the training shall be part of the proposal, and shall consist of pre-packaged courses offered by the manufacturer. The expectation duration is approximately twelve days, divided between a number of courses.

E34.6 Attendees:

E34.6.1 The attendees are expected to be HMI support specialists with programming expertise.

E34.7 Content:

E34.7.1 HMI and Historian System Content – The training course attendee shall be able to perform the following upon the completion of training. Note that multiple courses may be required to achieve the below objectives.

- (a) Operation and Maintenance of the HMI Servers / Clients, historian, and other tools.
- (b) Set-up and maintenance of a server redundancy system.
- (c) Create and deploy new HMI applications.
- (d) Utilizing templates / objects to model the process.
- (e) Acquisition of process data via various data formats.
- (f) Process data management techniques.
- (g) Set up alarming, including priorities and grouping.
- (h) Alarm history retrieval.
- (i) Set up historian logging.
- (j) Ad-hoc Historian data retrieval.
- (k) Formal historian data retrieval utilizing reporting.
- (l) Set-up and management of an appropriate security model.
- (m) Graphics development.
- (n) Trending system development and use.
- (o) Application maintenance, including back-up and restoration techniques.

E35. INTELLIGENT MOTOR CONTROL CENTERS – GENERAL

E35.1 Submittals:

E35.1.1 Provide submittals in accordance with E6.

- (a) Submit product data sheets for sills, busbars and compartments. Include product characteristics, physical size and finish.

- (b) Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- (c) Submit shop drawings and indicate:
 - (i) Outline dimensions.
 - (ii) Configuration of identified compartments.
 - (iii) Floor anchoring method and dimensioned foundation template.
 - (iv) Cable entry and exit locations.
 - (v) Dimensioned position and size of busbars and details of provision for future extension.
 - (vi) Schematic and wiring diagrams.
 - (vii) Network diagrams.
 - (viii) Layout of all customer starter assemblies.

E35.1.2 Closeout Submittals: provide as-built drawings and supplemental information for motor control centre.

- (a) Include data for each type and style of starter.

E35.2 General:

- (a) This section includes the requirements for 600V class low voltage Motor Control Centers (MCCs) for use on alternating current power systems.
- (b) Constructed to CSA C22.2, No 254-05.
- (c) Compartmentalized vertical sections with common power busbars.
- (d) Floor mounting, free standing, enclosed dead front.
- (e) Enclosure type as specified.
- (f) Wiring class as specified.
- (g) Interrupting ratings as specified.
- (h) Nameplates: white with black letters.
- (i) The MCC shall be provided with a factory wired and tested intelligent communication system.

E35.3 Structure:

- (a) The MCC shall be of dead front construction and shall consist of one or more vertical sections bolted together to form a rigid, free-standing assembly. The systems shall be designed to allow for the addition of future sections at either end and to permit the interchanging of units.

E35.4 Busbars:

- (a) Main horizontal and branch vertical, three phase high conductivity tin plated copper busbars in separate compartment, bare, self-cooled, extending entire width and height of motor control centre, supported on insulators.
- (b) Branch vertical busbars for distribution of power to units in vertical sections.
- (c) The vertical bus shall attach to the horizontal by at least two bolts.
- (d) No other cables, wires, equipment in main and branch busbar compartments.
- (e) Brace buswork to withstand effects of short-circuit current of 42 kA RMS symmetrical or as specified.
- (f) Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

E35.5 Ground Bus:

- (a) Tin plated copper ground bus extending entire width of motor control centre.

- (b) Vertical ground bus, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

E35.6 Vertical Section Construction:

- (a) Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.
- (b) Dimensions: 2286 mm (90") to 2324 mm (91.5") high, 508 mm (20") deep and 508 mm (20") wide, except as noted on the Drawings.
- (c) Assembled sections into a group having a common power bus and forming an enclosure to which additional sections may be readily added.
- (d) Design for all power and control connections to be made from the front. All bus and feeder bolted connections shall be accessible from the front.
- (e) Sections with horizontal wiring spaces top and bottom and with 102 mm full height vertical wiring spaces with cable tie supports. Insulate wireways from horizontal and vertical bus.
- (f) Each vertical section divided into compartment units, minimum 152 mm high.
- (g) Each unit to have complete top and bottom steel plate for isolation between units.
- (h) Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers. Horizontal wireways shall have removable covers held in place by captive screws.
- (i) Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.
- (j) Stab opening protection: Automatic shutters or removable protective caps.
- (k) Isolation barriers between units and wireways.
- (l) Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.
- (m) Incoming cables to enter at top and/or bottom.
- (n) Provision for outgoing cables to exit via top and/or bottom.
- (o) Removable lifting means.
- (p) Removable closing plates on each side of the vertical sections for future extension of the motor control centre including busbars without need for further drilling, cutting or preparation in field.
- (q) Vertical sections may be divided from one another for shipment to site, complete with hardware and instructions for re-assembly.
- (r) Provide all spaces complete with bussing hardware and other accessories required so that additional combination starter units can be readily installed. Provide barriers to isolate the space from all buswork.
- (s) Provide barriers to isolate all buswork to prevent accidental contact when starter units are removed or spaced are provided. Barriers shall also provide phase-to-phase isolation of the vertical bus.
- (t) All interior and exterior surfaces shall be painted. The interior of each vertical wireways shall be painted high visibility gloss white. All unpainted parts shall be plated for corrosion resistance.

E35.7 Unit Compartments:

- (a) Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.
- (b) Unit mounting:
 - (i) Engaged position - unit stabbed into vertical bus.

- (ii) Withdrawn position - unit isolated from vertical bus but supported by structure.
 - (iii) Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.
 - (iv) Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.
- (c) External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for padlock to lock operating handle in "off" position and lock door closed.
- (d) A mechanical interlock shall be supplied on all plug-in units to prevent insertion or removal of a unit from the structure when the unit operator handle is in the ON position. This interlock may not be defeated.
- (e) Hinge unit doors on same side.
- (f) Doors to be hinged in a manner that allows for the removal of individual doors without the removal of any door above or below.
- (g) Pushbuttons and indicating lights mounted on door front.
- (h) Devices and components by one manufacturer to facilitate maintenance.
- (i) Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.
- (j) Control wiring shall be extended from each starter module to the control terminal section, including all auxiliary contacts. A multi unit style terminal block having screw type terminal connections shall be installed on standoff supports on back plate.
- (k) All terminals shall be number coded or otherwise suitably identified to indicate which section or module of the MCC they are associated with and their function.
- (l) Complete control wiring diagrams for each starter with conductor identification clearly shown shall be affixed to the interior cover of the starter section or provide a book of wiring diagrams for all starters in each MCC.
- (m) Control transformer: single phase, dry type, 120 V secondary, complete with primary and secondary fuses, installed within starter compartment.
- (n) Equip door of each individual unit with a removable plate replaceable with similar plate complete with pushbuttons, pilot lights or selector switches as required. Use pilot lights of push-to-test type and push button of heavy-duty oil tight construction.
- (o) All interior and exterior surfaces shall be painted. The interior of unit compartment shall be painted high visibility gloss white. All unpainted parts shall be plated for corrosion resistance.
- (p) All wiring and interior components to be identified with a permanent computer-typed label consisting of black letters on a white background. Wire tags to be heat shrink type.
- (q) Unit Identification:
- (i) Type: lamacoid, 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self tapping screws, 20 mm text.
- (r) Warning signs:
- (i) To meet requirements of the local Electrical Inspection Department.
 - (ii) Type: lamacoid, 3 mm thick plastic engraving sheet, red face, white core, mechanically attached with self tapping screws, 20 mm text.

E35.8 Branch and Feeder Units:

E35.8.1 Desired Features:

(a) Unit Heights:

- (i) 15 - 150 A: 150 mm
- (ii) 175 - 250 A: 150 mm
- (iii) 300 - 400 A: 675 mm
- (iv) 450 - 600 A: 900 mm

(b) Interrupting Ratings:

- (i) Available 50 kA interrupting ratings with a standard moulded case breaker.

(c) Electronic Trip:

- (i) Available electronic trip features available for the entire circuit breaker range.
 - ◆ Long Time
 - ◆ Short Time
 - ◆ Instantaneous
 - ◆ Ground Fault

E35.9 Across-the-Line Motor Starters and Contactors:

E35.9.1 Required Features:

- (a) Motor starters and contactors by same manufacturer as MCC. The use of third party supply and assembly for these components in the motor control center is not acceptable.
- (b) Operating voltage: 600 VAC.
- (c) Utilize NEMA rated components. IEC rated starters are not acceptable.
- (d) Smallest size of starter: NEMA Size 1, unless otherwise indicated.
- (e) Operation: magnetic solenoid.
- (f) All coils to be epoxy coated.
- (g) Starters and contactors shall have a short circuit current rating of not less than 10 kA at 600V, or higher where specified.
- (h) Motor overload protection on each phase, manually resettable via the programmable controller and communication system or manual pushbutton on the door.
- (i) Transient suppressors required for all coils in each individual starter unit.
- (j) Complete with at minimum one (1) normally open auxiliary contact and one (1) normally closed contact.

E35.9.2 Desired Features:

(a) Unit Heights:

- (i) 15 - 150 A: 150 mm
- (ii) 175 - 250 A: 150 mm
- (iii) 300 - 400 A: 675 mm
- (iv) 450 - 600 A: 900 mm

E35.10 Motor Soft Starters:

- (a) Motor soft starters by same manufacturer as MCC. The use of third party supply and assembly for these components in the motor control center is not acceptable.
- (b) Operating voltage: 600 VAC.
- (c) Control Voltage: 120 VAC.
- (d) Rated amperes: Per load requirements.

- (e) Bypass contactor:
 - (i) Type: internal to soft starter module.
 - (ii) Rating: per load requirements.
- (f) Isolation Contactors:
 - (i) Isolation contactor to isolate input of soft starter module.
 - (ii) Coil voltage: 120 VAC
 - (iii) Auxiliary contacts: Qty 2, N.O.
- (g) Pilot devices:
 - (i) Unit door mounted selector switches, pushbuttons, and pilot lights for control and status indication.
 - (ii) Type: heavy-duty, oil-tight, NEMA rated.
- (h) Soft Starter Human-Interface Module / Keypad:
 - (i) Unit door mounted.
 - (ii) Facilitate soft starter configuration and monitoring.
- (i) Cooling:
 - (i) Unit door mounted filtered fans and relief vents as required to maintain soft starter module within operating temperature limits given a nominal ambient temperature of 10-30 °C.

E35.11 Intelligent Overloads / Motor Protection Relays:

E35.11.1 Requirements:

- (a) General Requirements:
 - (i) CSA and/or c-UL-us listed
 - (ii) Programmable/configurable electronic relay
 - (iii) Discrete logic inputs, relay outputs for control and fault monitoring
 - (iv) LEDs for status indication
- (b) Control Modes:
 - (i) Local terminal strip
 - (ii) Network (control via programmable controller). Configurable action upon communication failure or programmable controller failure; Hold, Run, and Stop. Controller to automatically resume network-based control upon restoration of network or programmable controller.

E35.11.2 Desired Features:

- (a) Metering Requirements:
 - (i) Line currents
 - (ii) Ground current
 - (iii) Current phase imbalance
 - (iv) Thermal capacity level
 - (v) Motor temperature sensor
- (b) Statistics:
 - (i) Protection fault counts
 - (ii) Protection warning counts
 - (iii) Diagnostic fault counts
 - (iv) Motor control function counts
 - (v) Fault history
- (c) Diagnostics:
 - (i) Internal watchdog
 - (ii) Controller internal temperature

- (iii) Temperature sensor connections
 - (iv) Current connections
 - (v) Communication loss
- (d) Motor Statistics:
 - (i) Cumulative run time
 - (ii) Motor starts per hour
 - (iii) Last start max current
 - (iv) Last start time
 - (v) Time to trip
 - (vi) Time to reset
- (e) Fault monitoring:
 - (i) Run command check
 - (ii) Stop command check
 - (iii) Run check back
 - (iv) Stop check back
 - (v) PTC connection reversal
 - (vi) CT reversal
 - (vii) Current phase reversal
 - (viii) Internal stack overflow, watchdog, ROM checksum, CPU, and internal temperature
- (f) Protection:
 - (i) Thermal overload
 - (ii) Current phase imbalance
 - (iii) Current phase loss
 - (iv) Current phase reversal
 - (v) Long start
 - (vi) Jam
 - (vii) Undercurrent
 - (viii) Overcurrent
 - (ix) Ground current
 - (x) Motor temperature
 - (xi) Rapid cycle lockout
- (g) Motor temperature sensor compatibility:
 - (i) PTC binary
 - (ii) PTC analog
 - (iii) NTC analog
- (h) Thermal overload characteristic:
 - (i) Definite
 - (ii) Inverse thermal
- (i) Fault management:
 - (i) Manual reset
 - (ii) Automatic reset
 - (iii) Remote reset
- (j) Communications:
 - (i) Facilitates monitoring and control by way of a network interface.
 - (ii) Programming and configuration:

- (iii) Controller capable of being programmed and configured via multi-lingual, PC-based software that operates on the Microsoft Windows operating system.
- (iv) PC software can be connected in a 1-to-1 configuration to a single controller, or in a 1-to-many configuration to multiple controllers.
- (v) Controller capable of being automatically re-configured upon replacement due to failure by programmable controller system.

E35.12 MCC Network:

E35.12.1 General Requirements:

- (a) Ethernet throughout MCC, or
- (b) Ethernet to MCC, Profibus within MCC.

E35.12.2 Network Availability

- (a) The MCC shall be connected to a fault tolerant Ethernet ring network or a dual redundant network.
- (b) MCC internal network configurations shall limit the extent of device failures upon a single device or cable fault.
- (c) The network shall be configured such that a maximum of 10 devices may be unavailable upon any device or cable failure.
 - (i) Star-based Ethernet networks shall not have more than 10 devices per network switch.
 - (ii) PROFIBUS based networks shall not have more than 10 devices per network segment, unless network redundancy is provided.

E35.12.3 Ethernet Switches:

- (a) Where Ethernet based networks are utilized, the MCC shall include a network switch for connection between the programmable controller system and each intelligent overload / motor protection relay. The general requirements for the network switch are as follows:
 - (i) Type: Managed / unmanaged as recommended by manufacturers.
 - (ii) Speed, minimum: 100 Mbit
 - (iii) Auto MDI / MDI-X
 - (iv) Port quantity: Sufficient for quantity of intelligent overloads / motor protection relays installed plus 50% spare.
 - (v) Power supply: 24VDC
 - (vi) Desired Feature: Network switches will have dual 24 VDC power supply inputs, connected to independent power supplies.

E35.13 Network Cabling:

(a) Required Features:

- (a) The MCC shall employ a network communication cabling system to interconnect units within the MCC.
- (b) Where a top-mounted horizontal bus is utilized, the network cabling shall be routed through the lower horizontal wireway to isolate the network from the horizontal bussing routed through the top.
- (c) Provisions for appropriate terminators and grounding shall be provided.
- (d) Addition, removal, or rearrangement of units shall not interrupt the trunk line and shall not affect the cabling of other units attached to the trunk line.
- (e) Network cabling shall be 600V rated or otherwise approved for application in a 600V system.

(b) Desired Features:

- (a) A communication barrier in the full-depth vertical wireway shall serve to separate communications from power cabling and to prevent noise interference on the network cable.
- (b) Cable coupler design shall include a vibration-resistant ratchet to prevent loosening.
- (c) Where the communication system is Ethernet based, cabling shall be 600V rated Category 6 shielded twisted pair Ethernet cable with RJ45 connector.
- (d) Identification: all communication cabling to be identified at both ends with permanently attached, heat-shrink, computer-typed label with black letters on a white background.

E35.14 Transient Voltage Surge Suppressor:

E35.14.1 Required Features:

- (a) TVSS units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).
- (b) Maximum Continuous Operating Voltage (MCOV): The MCOV shall not be less than 115% of the nominal system operating voltage.
- (c) The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
- (d) Protection Modes – The TVSS must protect all modes of the electrical system being utilized. The required protection modes are:
 - (i) 3Ø, 3W System: L-L, and L-G
 - (ii) 3Ø, 4W Wye System: L-L, L-N, L-G, and N-G
 - (iii) 1Ø, 3W Wye System: L-L, L-N, L-G, and N-G
- (e) Nominal Discharge Current (In) – All TVSSs applied to the distribution system shall have a 20kA In rating regardless of their TVSS Type (includes Types 1 and 2) or operating voltage. TVSSs having an In less than 20kA shall be rejected.
- (f) ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:
 - (i) L-N, L-G, N-G:
 - .1 120/208 V: 700V
 - .2 347/600 V: 1500V
 - (ii) L-L:
 - .1 120/208 V: 1200V
 - .2 347/600 V: 3000V
- (g) Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV.
- (h) Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be 120 kA.
- (i) The TVSS shall be capable of being installed immediately following the load side of the main breaker or main switch.
- (j) The MCC shall be capable of re-energizing upon removal of the TVSS.
- (k) The TVSS shall be fed by and located next to a breaker, appropriately rated as directed by the TVSS manufacturer, for connection of the TVSS to the MCC.
- (l) The TVSS shall be included and mounted within the MCC by the manufacturer of the MCC where shown on the drawings.
- (m) The TVSS shall be CSA or cUL approved.

E35.14.2 Desired Features:

- (a) Maintenance Free Design – The TVSS shall be maintenance free and shall not require any user intervention throughout its life. TVSSs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. TVSSs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. TVSSs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
- (b) Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method.
- (c) Monitoring Diagnostics – Each TVSS shall provide the following integral monitoring options:
 - (i) Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of each protection mode on each phase.
- (d) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes.
- (e) The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
- (f) Surge counter with door-mounted display.
- (g) Audible alarm – switchable on/off.
- (h) Dry contact for monitoring.

E35.15 Power Meter:

E35.15.1 Required Features:

- (a) Power meter to be microprocessor based and multifunction for electrical measurement on a 3 phase power system.
- (b) User programmable for voltage range to any PT ratio.
- (c) Accept direction voltage input range up to 347 V line-to-neutral, and a range of up to 600 V line-to-line.
- (d) Accept current inputs of up to 5 Amps nominal, 10 Amps full scale.
- (e) The meter shall provide true RMS measurements of the line-to-neutral voltages, line-to-line voltages, phase currents, and neutral current where utilized.
- (f) Provide appropriate fuse protection.
- (g) Provide CT shorting switch.
- (h) Provide dedicated CTs for power meters.
- (i) Provide PTs as required.
- (j) Function requirements:
 - (i) Volts, Amp, kW, kVAR, PF, kVA (per phase)
 - (ii) Frequency, kWh, kVAh, kVARh
 - (iii) Harmonics measurement, individual, even, and odd up to 15th.
- (k) Communications:
 - (i) Protocol compatible with the proposed programmable controller and communications system.
 - (ii) Minimum speed: 10 Mbit.

(l) Operating temperature, minimum: 0 to 40 °C

E35.15.2 Desired Features:

(a) The meter shall have an accuracy of +/- 0.25% or better for volts and amps, and 1.5% for power and energy functions.

E35.16 Arc Resistant Features:

E35.16.1 Desired Features:

(a) MCC tested to IEEE C37.20.7 without current limiting main device.

(b) Reinforced enclosure and front doors.

(c) Internal venting system.

(d) Automatic shutters in plug-in unit compartments.

(e) Insulated bus bar system.

(f) Type 2 accessibility.

E35.17 Accessories:

(a) Pushbuttons and selector switches:

(i) Heavy duty, oil tight.

(ii) Manufactured by same as MCC.

(b) Indicating lights:

(i) Heavy duty, oil tight.

(ii) Bulb: LED type.

(iii) Available colours: Blue, Red, Green, Amber

(iv) Manufactured by same as MCC.

E36. MCC SYSTEM 1

E36.1 The general requirements are indicated in E35.

E37. MCC ANNUAL SUPPORT SERVICES

E37.1 The MCC annual support services shall include the following:

E37.1.1 Provide telephone technical support, available from 8 am to 4 pm CST, Monday to Friday.

E37.1.2 Provide e-mail technical support.

E37.1.3 Provide self-service on-line support with the following:

(a) Comprehensive access to the manufacturer's knowledge base with technical articles, tech notes, manuals, instructions, etc.

(b) Downloads of the latest firmware updates and service patches for the motor control system components.

E37.2 Desired features:

E37.2.1 Telephone technical support:

(a) Provide toll-free phone support

(b) Provide 24 hour support, 7-days/week.

(c) Provide a high level accessibility of technical support personnel.

E37.3 The support service shall be available to a minimum of twenty (20) users.

(a) Desired feature:

(i) Provide access to technical support to an unlimited number of City users.

E37.4 The City may at its discretion choose whether to purchase or renew the update and support service for any given year on an annual basis. There shall be no additional charges or restrictions on future purchases of the service if the City chooses not to purchase the service for any number of years.

E38. VARIABLE FREQUENCY DRIVES – GENERAL

E38.1 General Requirements:

- (a) VFDs manufactured by same manufacturer as proposed control system and motor control centre.
- (b) Manufacturer shall have minimum ten years experience in the design and manufacture of Variable Frequency Drives (VFDs).
- (c) VFDs that are manufactured by a third party and “brand labelled” will not be accepted.
- (d) VFDs shall be a heavy-duty, industrial class, electronic adjustable frequency and voltage output unit suitable for pump and fan applications.
- (e) Designed to operate standard squirrel cage induction motor with a 1.15 S.F. or definite purpose motors meeting NEMA MG1 Part 31.
- (f) Harmonic loading will not exceed a motor service factor of 1.0.
- (g) CSA or cUL certified.
- (h) Be capable of continuous full load operation with a line input voltage of +/- 10% of nominal.
- (i) Input frequency tolerance range of 48 to 63 Hz.
- (j) VFD to employ a minimum 6-pulse pulse width modulated (PWM) inverter system utilizing Insulated Gate Bipolar Transistors (IGBT) power switching devices.
- (k) Be capable of re-accelerating the driven equipment, following voltage dips greater than 20% of the rated input power supply, of up to 5 seconds duration, without the need to come to a complete stop.
- (l) Be capable to continue operation without coming to a standstill or resulting in a process shutdown, following any momentary voltage dips in the input power supply, auxiliary power supply, or both, of less than 20% rated voltage, which last for less than 0.5 second.
- (m) Designed to provide output requirements dictated by the speed/torque characteristics of motor and driven equipment over the entire speed range. The motors may be supplied by others.
- (n) VFD shall convert the line input power to adjustable AC voltage and frequency output power. The output power shall be controlled such that permissible volts/Hertz ratio is not exceeded throughout the specified operating speed range, over a voltage range of $\pm 10\%$ and frequency variation of $\pm 5\%$.
- (o) The VFD output frequency shall not deviate more than $\pm 1\%$ of any given set point within the operating frequency range.
- (p) The VFD shall be provided with radio interference suppression and limit radio interference values to within the limits of local code requirements.
- (q) The telephone influence factor shall be in accordance with maximum values specified by local authorities.
- (r) Overload capability:
 - (i) 110% overload for 60 seconds.
 - (ii) 150% overload for 2 seconds.
- (s) Operation modes supported include V/F control and sensor-less vector control.
- (t) Operate at displacement power factor of 0.98 or greater at all speeds and loads.

E38.2 Application:

- (a) Industrial-grade VFD shall be provided.

- (b) Assume all applications are pumps and/or fans.

E38.3 Enclosure

- (a) VFD to be suitable for mounting either in MCC, in stand-alone enclosure, or on the wall (NEMA 1).
- (b) Desired feature:
 - (i) VFD offered in NEMA 4 / 4X / 12 configurations.

E38.4 I/O Capability

- (a) Discrete Inputs, minimum:
 - (i) Qty 4: 24 VDC
- (b) Discrete Outputs, minimum:
 - (i) Qty 4: Form A dry contact, rated 2 Amps @ 120 VAC / 1 Amp @ 24 VDC
- (c) Analog Inputs:
 - (i) Qty 2: configurable for 0-10 VDC / 0-20 mA / 4-20 mA
- (d) Analog Outputs:
 - (i) Qty 2: configurable for 0-10 VDC / 0-20 mA / 4-20 mA

E38.5 Environment compatibility:

- (a) VFD suitable for installation within individual drip proof, Type 12 free-standing enclosure complete with fans and filters. VFD shall be able to operate under these conditions with no special cleaning requirements.
- (b) Ambient temperature range of 0°C to 50°C without derating.
- (c) Humidity 5 to 95 percent (non-condensing).
- (d) Vibration up to 0.5 g.
- (e) Altitude 0 to 1000 m above sea level.

E38.6 Operational features:

- (a) Available panel-mount keypad for programming, monitoring, and operating the drive, with ability to active password protection to prevent unauthorized programming and configuration changes and drive operation.
 - (i) VFDs mounted in MCCs must have a keypad mounted in the MCC door.
- (b) Capability to view active faults, clear active faults, and view fault history via keypad.
- (c) Drive control and monitoring via keypad, local discrete and analog I/O terminals, and/or network interface.

E38.7 Communications:

- (a) Communications adapter(s) to facilitate remote monitoring and control via the programmable controller system. Communications protocols compatible with the proposed programmable controller systems specified herein.
- (b) Configurable control behaviour upon communication failure or programmable controller failure including (1) stopping and displaying a fault, (2) running at a programmable preset speed, or (3) holding the VFD speed based on the last good reference received.
- (c) Communications protocol(s) compatible with proposed programmable controller systems.

E38.8 Protective functions:

- (a) VFD failure
- (b) Ground fault in VFD
- (c) Ground fault on VFD output
- (d) VFD overcurrent

- (e) Supply system over or under voltage
 - (f) Supply system phase voltage unbalance
 - (g) DC link fault
 - (h) Voltage/frequency ratio incorrect
 - (i) 5% frequency deviation from setpoint
 - (j) Loss of control signal
 - (k) Control electronics fault
 - (l) Motor stalled
 - (m) VFD over temperature
 - (n) Motor over temperature (based on thermal model or temperature sensor)
- E38.9 Provide a minimum of ten licences for VFD configuration software, with the following requirements:
- (a) PC-based software, compatible with the Microsoft Windows operating system.
 - (b) Provide full diagnostic and configuration capability for all the VFDs proposed.
 - (c) Desired features:
 - (i) Software to have full off-line configuration capabilities, including saving and loading of device configurations.
 - (ii) Software to have the capability to communicate with all the proposed drives over the Ethernet network connection.
- E38.10 Parts availability:
- (a) Guarantee that parts for the drive units be available for a minimum of ten years from time of delivery.
- E38.11 Integration with the control system
- (a) VFDs to be capable of integration into the proposed control system by means of software wizards or menu-driven configurator to facilitate rapid integration and commissioning of VFDs. Programmable controller software to incorporate pre-configured user defined data types (tag structures) and logic for control and monitoring of the VFD over the communication network.
- E38.12 Desired Features:
- E38.12.1 Redundant Communications
- (a) Provide a means for redundant communications to the control system.
- E38.12.2 Easy Drive Replacement
- (a) The drive will be able to have all firmware and configuration automatically loaded and configured from the control system, when the drive is replaced after a failure. Personnel shall not be required to perform any software configuration or loading upon replacement.
- E38.12.3 Input harmonics that are lower than typical six-pulse VFDs.
- E38.12.4 Options available to reduce VFD input harmonics via one or more of the following technologies:
- (a) 12-pulse drive
 - (b) 18-pulse drive
 - (c) 24-pulse drive
 - (d) Active front end
 - (e) Input filter

- E38.12.5 It is desired that all drive features are accessible to the City, including but not limited to:
- (a) Reset of internal fault alarms, including fan failure.
 - (b) Access to all drive parameters.

E39. VARIABLE FREQUENCY DRIVE, 7.5 KW

E39.1 General:

- (a) Provide a variable frequency drive in accordance with E38.

E39.2 Application Requirements:

- (a) Voltage: 600 volts, 3-phase
- (b) Motor: 7.5 kW (10 hp), Inverter-Duty rated.
- (c) Application: Fan, normal duty.
- (d) Control mode: V/Hz or sensorless vector control.

E39.3 Front end:

- (a) 6-pulse rectifier with choke.

E40. VARIABLE FREQUENCY DRIVE, 37.3 KW

E40.1 General:

- (a) Provide a variable frequency drive in accordance with E38.

E40.2 Application Requirements:

- (a) Voltage: 600 volts, 3-phase
- (b) Motor: 37.3 kW (50 hp), Inverter-Duty rated.
- (c) Application: Fan, normal duty.
- (d) Control mode: Sensorless vector control.

E40.3 Front end:

- (a) 6-pulse rectifier with choke.

E41. MCC AND VFD LOCAL TRAINING SESSION

E41.1 Overview

- E41.1.1 Provide instruction to designated City personnel in the operation and maintenance of the motor control centres and variable frequency drives.

E41.2 Location

- E41.2.1 The location of the training will be in the City of Winnipeg, in a facility provided by the City.

E41.3 Submittals

- E41.3.1 Submittals to be in accordance with E6.

- E41.3.2 Submit the names and qualifications of the proposed instructors.

- E41.3.3 Submit training proposal complete with hour by hour schedule including brief overview of content of each training segment a minimum of 30 working days prior to the anticipated date of beginning of training.

E41.4 Quality Assurance

- E41.4.1 Provide competent instructors thoroughly familiar with all aspects of the MCC and VFD systems.

- E41.4.2 The Contract Administrator may reject instructors it deems to not be qualified.
- E41.4.3 In the event that the training provided is not satisfactory, reduction of payment as per D18.6(a) may be applied.
- E41.5 Duration
- E41.5.1 The training shall be a minimum of six (6) hours in duration, excluding coffee and lunch breaks.
- E41.6 Materials
- E41.6.1 Provide equipment, visual and audio aids, and materials.
- E41.6.2 Supply manual for each trainee, describing in detail the information included in each training program.
- E41.7 Attendees
- E41.7.1 The attendees are expected to include, but not be limited to:
- (a) Electrical and instrumentation maintenance personnel.
 - (b) Programmable controller support specialists.
- E41.8 Content
- E41.8.1 Overview of the equipment.
- E41.8.2 Equipment maintenance training including:
- (a) Installation
 - (b) Troubleshooting
 - (c) Preventative maintenance
 - (d) Replacement of modules
 - (e) Fieldbus diagnostics
 - (f) Configuration of equipment parameters.
- E41.8.3 Maintenance use of equipment configuration software, including:
- (a) Basic operation of the software
 - (b) Connecting to intelligent starts and VFDs.
 - (c) Download and upload of software configuration.
 - (d) Diagnostics and troubleshooting.

E42. VFD ANNUAL SUPPORT SERVICES

- E42.1 The VFD annual support services shall include the following:
- E42.1.1 Provide telephone technical support, available from 8 am to 4 pm CST, Monday to Friday.
- E42.1.2 Provide e-mail technical support.
- E42.1.3 Provide self-service on-line support with the following:
- (a) Comprehensive access to the manufacturer's knowledge base with technical articles, tech notes, manuals, instructions, etc.
 - (b) Downloads of the latest firmware updates and service patches for the motor control system components.
- E42.2 Desired features:
- E42.2.1 Telephone technical support:
- (a) Provide toll-free phone support

- (b) Provide 24 hour support, 7-days/week.
- (c) Provide a high level accessibility of technical support personnel.

E42.3 The support service shall be available to a minimum of twenty (20) users.

(a) Desired Feature:

- (i) Provide access to support for an unlimited number of City users.

E42.4 The City may at its discretion choose whether to purchase or renew the update and support service for any given year on an annual basis. There shall be no additional charges or restrictions on future purchases of the service if the City chooses not to purchase the service for any number of years.

E43. MOTOR CONTROL FIELD SERVICE

E43.1 Provide on-site field service at an hourly rate, as requested by the City.

E43.2 Provide field service, on an as-requested basis, on the motor control centre and VFD installations. Field service shall not be applicable for warranty.

E43.3 The rate provided for field service shall be all inclusive and include travel costs, tools, shop supplies, etc.

E43.4 Field service rates shall not apply to MCC start-up services, which shall be included in the equipment prices.

E43.5 Service Personnel:

E43.5.1 The manufacturer shall directly employ a nationwide service organization, consisting of factory trained field service personnel dedicated to the start-up, maintenance, and repair of motor control equipment. The organization shall have an authorized field service center within 300 km of Winnipeg.

E44. INDUSTRIAL ETHERNET SWITCH

E44.1 Application:

- (a) Provide industrial Ethernet switches to meet all required remote I/O, and intelligent device connectivity requirements. Including pricing for switches in Form B, Items 1, 2, and 3.
- (b) Provide industrial Ethernet switches within intelligent Motor Control Centres.
- (c) Provision of industrial Ethernet switches between controllers and HMI systems, and to connect HMI systems is not required.

E44.2 Requirements:

E44.2.1 Type: Managed

E44.2.2 Features:

- (a) Spanning Tree Protocol (support for ring topology)
- (b) Port security
- (c) Port mirroring
- (d) IGMP snooping
- (e) Quality of Service
- (f) Virtual local area networks

E44.2.3 Power Supply: 24 VDC

- (a) Restore network communication within 200 ms upon failure.

- E44.2.4 RJ45 ports:
- (a) Auto speed negotiation: 10/100 Mb/s.
 - (b) Auto MDIX on all ports.

E44.3 Desired Features

- E44.3.1 Fiber ports:
- (a) Optical Transceiver: SFP (Small Form-factor Pluggable).
 - (b) Fiber Type: multi-mode.
 - (c) Connectors: LC.
 - (d) Standard: 1000Base-SX.
 - (e) Speed: 1000 Mb/s.

- E44.3.2 Native diagnostic integration of the Ethernet switch with the control system.

E45. SPARE PARTS

E45.1 Replacement Parts Stocking

- (a) Parts shall be available through an extensive network to ensure around-the-clock parts availability throughout the country.
- (b) The manufacturer shall stock spare parts in a manner to provide expeditious supply of parts to the City, upon placement of a rush order.

E45.2 Desired Feature:

- (a) Provide localized spare parts warehousing and expeditious means of delivery.

E46. ADDITIONAL TRAINING

E46.1 Identify additional training available, along with cost and typical locations in Form P.

E46.2 Desired feature:

- (a) Provide a comprehensive set of training programs available at a reasonable cost to the City.

E47. HISTORIAN CENTRAL ARCHIVE SERVER SOFTWARE

E47.1 Supply of a Historian central archive server is a desired feature, but is not deemed to be a mandatory requirement.

E47.2 General

- (a) The historian software shall comply with E28.
- (b) A historian central archive server shall be provided for a central location to gather and archive historical data from the three (3) historian facility servers.
- (c) The historian shall be a similar product to the proposed facility historians.

E47.3 Requirements include, but are not limited to:

- (a) Compatible with servers running the Windows Server 2008 or newer operating system.

E47.4 Submittals

- (a) Provide details regarding all server hardware requirements, including but not limited to:
 - (i) processor speed and type,
 - (ii) speed, type, and quantity of RAM,
 - (iii) network adapter(s), and

- (iv) hard drive speed, size, type, and configuration (eg. RAID 10).

E47.5 Capability Requirements

- (a) Provide sufficient capability and licensing to fully archive the individual historians from each of the three facilities (including the spare capacity of each facility) + 10% to address a potential fourth data source.

E47.6 Licence Requirements

- (a) Access for fifteen (15) floating pool users or thirty (30) fixed named users.

E48. VERSION MANAGEMENT SOFTWARE

E48.1 Supply of Version Management Software is not a mandatory requirement.

E48.2 Scope of Supply

- (a) The software shall be supplied and implemented for all Programmable Controller, HMI, and Historian Programming Software and associated data files for all three City wastewater facilities (NEWPCC, SEWPCC, WEWPCC).

E48.3 Requirements:

- (a) Facilitate secure access to the control system documented, restricting access to unauthorized users attempting to perform programming and/or configuration changes to the control system components.
- (b) Provide a documented audit trail of who made what changes and when those changes were made, including but not limited to the following:
 - (i) User login / logout.
 - (ii) Manual changes of controller data values (tag values, timer and counter presets, etc.)
 - (iii) Addition or deletion of programmable logic.
 - (iv) Modification of I/O configuration.
 - (v) Modification of alarm configuration.
 - (vi) Controller firmware changes.
- (c) Maintain version control of all program and system files:
 - (i) Check-out: write the selected file or folder to a working folder with read-write access and locks the selection to prevent multiple-user editing.
 - (ii) Check-in: Reads the local working file or folder and updates the source control repository, creating new versions as needed.
 - (iii) Get: Writes the selected file or folder to a working folder with read-only access.
 - (iv) Undo Check-out: Returns the selection to an unchecked out state and unlocks the selections.
- (d) Maintain backups of controller programs to facilitate previous program version restoration if required.
- (e) Provide means to compare and display changes to controller programs and configuration files.
- (f) Provide means to access latest (current) version of controller program to ensure previous changes are not lost.
- (g) View and modify the configuration for control equipment.
- (h) Utilize a centralized database for storage of version management information.
- (i) Provide means to generate and distribute pre-configured and ad-hoc reports.

E48.4 Desired features:

- (a) Provide means for asset management of touchscreen HMI devices, including HMI application and configuration changes.

E48.5 Users

- (a) The version management software shall be provided in an interrogated, cohesive system for all users of the programmable controller programming software and HMI programming software.

E49. INFORMATION SERVER SOFTWARE

E49.1 Supply of Information Server Software is not a mandatory requirement.

E49.2 Software Description

- (a) A web-based tool to provide data analysis and reporting of data from the control system and other data sources.
- (b) The Information Server will compile, evaluate and graphically visualize the process values, of the process control system.
- (c) The Information Server will provide access to data in the historian or HMI servers
- (d) Prepared and saved reports will be provided via a web interface and presented both graphically and in a tabular format.

E49.3 Scope of Supply

- (a) The software shall be supplied and implemented for all three City wastewater facilities (NEWPCC, SEWPCC, WEWPCC).

E49.4 Features:

- (a) Utilizes real-time and historical information from the control system, historian, and 3rd party applications.
- (b) Performs data analysis.
- (c) Performs reporting via web-based systems utilizing pre-developed reports. Reports shall support text, tables, and a comprehensive variety of graphs.
- (d) Provide export capabilities for integration with Microsoft Word and Excel.

E49.5 Scope of Data Accessibility

- (a) The information Server shall be able to report on data from any of the three wastewater treatment facilities.

E49.6 Users

- (a) The software shall be capable of providing web access to ten (10) concurrent users via a floating licence system, and be expandable up to a minimum of 50 concurrent users.
 - (i) If three servers are proposed, with each serving one facility, the licences shall be split between the facilities.

E50. METRICS SERVER SOFTWARE

E50.1 Supply of Metrics Software is not a mandatory requirement.

E50.2 Software Description

- (a) A web-based tool to provide data analysis and reporting of key performance indicators (KPIs) from the control system.

E50.3 Scope of Supply

- (a) The software shall be supplied and implemented for all three City wastewater facilities (NEWPCC, SEWPCC, WEWPCC). The solution could require a single central server, or a server at each facility.

E50.4 Features:

- (a) Reports Overall Equipment Effectiveness
- (b) Sort and group analysis by facility, process area, equipment, time, day, operator, etc.
- (c) Utilizes the historian as a data source.
- (d) Performs reporting via web-based systems utilizing pre-developed reports. Reports shall support text, tables, and a comprehensive variety of graphs.
- (e) Provide export capabilities for integration with Microsoft Word and Excel.

E50.5 Scope of Data Accessibility

- (a) The Metrics Server shall be able to report on data from any of the three wastewater treatment facilities.

E50.6 Users

- (a) The software shall be capable of providing web access to six (6) concurrent users via a floating licence system, and be expandable up to a minimum of 25 concurrent users.
 - (i) If three servers are proposed, with each serving one facility, two (2) concurrent users shall be provided per facility.

E51. ENTERPRISE DATABASE INTEGRATION SOFTWARE

E51.1 Supply of Enterprise Database Integration Software is not a mandatory requirement.

E51.2 Background

- (a) The City has a Computerized Work Management System (CWMS) that tracks assets and work orders, and is utilized extensively by the maintenance personnel in the wastewater treatment facilities. The City's current system is based upon the Oracle Work and Asset Management Implementation (WAM), previously identified as Synergen.
- (b) It is desired that the City would be able to implement some or all of the below features:
 - (i) Abnormal events, such as an alarm or a high process level, can be configured to automatically generate a work order with the appropriate parameters.
 - (ii) Utilize equipment runtimes to automatically generate work orders with the appropriate parameters.
 - (iii) Manually initiate a work order from the HMI. (lower priority)
 - (iv) View work orders for specific equipment from the HMI. (lower priority)

E51.3 Software Description

- (a) A software tool to allow integration of the proposed control system with enterprise systems including databases.
- (b) Communicates data between the two systems based upon pre-defined events.
- (c) Enters transactions into databases based upon control system condition and events.

E51.4 Scope of Supply

- (a) The software shall be supplied and implemented for all three City wastewater facilities (NEWPCC, SEWPCC, WEWPCC). The solution could require a single central server, or a server at each facility.
- (b) Customization of the software for the specific City application is not in the scope of work.
 - (i) Desired feature: Experience with integration of a similar application, utilizing the proposed software, is preferred.

E51.5 Features:

- (a) Provide a high level of data integrity.
- (b) Support Oracle databases as well as other industry standard databases.
- (c) Allow for configuration without programming.
- (d) Provide diagnostic tools.

E51.6 Licensing:

- (a) Provide sufficient capacity and licensing to at minimum support the following:
 - (i) NEWPCC: 3000 data points
 - (ii) SEWPCC: 1500 data points
 - (iii) WEPCC: 1000 data points
- (b) Provide any control system, HMI, and 3rd party licences required to operate the software. Licences for enterprise data systems shall not be required.

E52. INTEGRATED SOLUTION

E52.1 Provide an integrated solution, whereby the VFDs, MCCs, fieldbus instruments, process controllers, HMI, and enterprise functions all work together in a manner to reduce the efforts required to integrate and maintain the various system components.

E52.2 Desired Feature – VFD Integration

- (a) Provide pre-built function blocks, symbols, and faceplates to integrate the VFDs with the complete control system with minimum manual configuration. Provide:
 - (i) Drive control
 - (ii) Drive monitoring
 - (iii) Full diagnostics and fault capability
 - (iv) Process interlocking capability

E52.3 Desired Feature – Intelligent Motor Starter Integration

- (a) Provide pre-built function blocks, symbols, and faceplates to integrate the intelligent motor starters with the complete control system with minimum manual configuration. Provide:
 - (i) Starter control
 - (ii) Motor starter monitoring
 - (iii) Full diagnostics and fault capability
 - (iv) Process interlocking capability

E52.4 Desired Feature – Fieldbus Instrument Integration

- (a) Provide pre-built function blocks, symbols, and faceplates to integrate the intelligent fieldbus devices with the complete control system with minimum manual configuration. Provide:
 - (i) Control, as applicable to the instrument (i.e. valves)
 - (ii) Monitoring
 - (iii) Configuration
 - (iv) Full diagnostics and fault capability
 - (v) Process interlocking capability

E52.5 Desired Feature – Standard Automation Library

- (a) A library of standard prebuilt control algorithms for process control shall be available along with their associated HMI faceplates/symbols. The standard library shall consist of the following control strategies and pre-engineered symbols/faceplates:
 - (i) Standard PID Controller
 - (ii) CASCADE PID Controller

- (iii) Ratio Controller
- (iv) Split Range Controller
- (v) Manual Loader
- (vi) Analog Value Monitoring with Alarming
- (vii) Motor (Start / Stop) with Interlocks
- (viii) Two speed motor control
- (ix) Reversing motor control
- (x) On/Off Valve control with feedback monitoring
- (xi) Motorized valve control with feedback monitoring
- (xii) The control function blocks shall feature the following high level functions:
- (xiii) Others as appropriate.

E52.6 Desired Feature - Wastewater Library

- (a) Provide a tested and certified wastewater-specific function block library with a model application. The supplied model application should integrate industry-typical applications from the field level to the automation level to the operations and monitoring level for the water and wastewater treatment industry.
- (b) The library should be implemented utilizing the IEC 61131-3 languages.
- (c) The supplied model solution must contain start-up strategies for back-up units; digital value control and monitoring; analog value control and monitoring; volume recording and metered value recording; a switching and operation hours counter; split range control; control with analog position feedback signal; cascade control; PID control for actuators; various control functions with feedback for valves and motors with fixed speeds, variable speeds and variable directions, each with interfaces for local control panels.
- (d) The function block library will contain at least the following function block types:
 - (i) 3-point actuator block
 - (ii) Operation mode switch with at least three (3) levels
 - (iii) Unit function blocks with automatic switchover based on operating hours or managed control for up to 16 units
 - (iv) Adjustable polygon progression with at least eight (8) reference points
 - (v) Process signal selection from at least two (2) measured, counted or digital values
 - (vi) Addition of two values including factor adjustment
 - (vii) Measurement monitoring for up to eight (8) limits
- (e) The associated symbols shall be copied into the process diagrams of the process control system and incorporated into the process through a configuration assistant. Further requirements for the faceplates with fixation when changing screens are:
- (f) enabling; protection; interlocks; operation status; feedback signals; commands; run time, maintenance, limit and gradient parameters; pre-configuration of simulation, manual and substitution parameters; trends, messages, error messages and alarms with associated locking functionality and separate preview information; notepad functions. The signal identifiers of the function blocks must be consistent and uniform. Activated process symbols in selected diagrams must be marked with the appropriate colors.