THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 892-2007

DUGALD ROAD WASTEWATER PUMPING STATION

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PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 DUGALD ROAD WASTEWATER PUMPING STATION

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, March 13, 2008.

B2.2 Bids 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. SITE INVESTIGATION

B3.1 Further to C3.1, the Bidder may view the Site without making an appointment.

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D3.1.

B4.2 If the Bidder finds errors, discrepancies or omissions in the Bid Opportunity, or is unsure of the meaning or intent of any provision therein, the Bidder shall notify the Contract Administrator of the error, discrepancy or omission, or request a clarification as to the meaning or intent of the provision at least five (5) Business Days prior to the Submission Deadline.

B4.3 Responses to enquiries which, in the sole judgment of the Contract Administrator, require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator to all Bidders by issuing an addendum.

B4.4 Responses to enquiries which, in the sole judgment of the Contract Administrator, do not require a correction to or a clarification of the Bid Opportunity will be provided by the Contract Administrator only to the Bidder who made the enquiry.

B4.5 The Bidder shall not be entitled to rely on any response or interpretation received pursuant to B4 unless that response or interpretation is provided by the Contract Administrator in writing.

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 Bid Opportunity, 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 Branch internet site at http://www.winnipeg.ca/matmgt.

B5.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Branch internet site 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 10 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B6. SUBSTITUTES

B6.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.

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 five (5) 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 Plant, Material or method 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 proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;

(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 proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.

B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his 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 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 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 B15.

B6.9 No later claim by the Contractor for an addition to the Total Bid Price because of any other changes in the Work necessitated by the use of an approved equal or an approved alternative will be considered.

B7. BID COMPONENTS

B7.1 The Bid shall consist of the following components:

(a) Form A: Bid;

(b) Form B: Prices;

(c) Form G1: Bid Bond and Agreement to Bond, or
Form G2: Irrevocable Standby Letter of Credit and Undertaking, or
a certified cheque or draft;

B7.2 Further to B7.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B6.

B7.3 All components of the Bid 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 Bid.

B7.4 The Bid shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

B7.4.1 Samples or other components of the Bid which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder's Bid.

B7.5 Bidders are advised not to include any information/literature except as requested in accordance with B7.1.

B7.6 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, may result in the Bid being determined to be non-responsive.

B7.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B7.8 Bids shall be submitted to:

The City of Winnipeg
Corporate Finance Department
Materials Management Branch
185 King Street, Main Floor
Winnipeg MB R3B 1J1

B8. BID

B8.1 The Bidder shall complete Form A: Bid, making all required entries.

B8.2 Paragraph 2 of Form A: Bid shall be completed in accordance with the following requirements:

(a) if the Bidder is a sole proprietor carrying on business in his own name, his 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 own, the business name and the name of every partner or corporation who is The City of such business name shall be inserted.

B8.2.1 If a Bid 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: Bid, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.

B8.4 Paragraph 12 of Form A: Bid shall be signed in accordance with the following requirements:

(a) if the Bidder is a sole proprietor carrying on business in his 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 own, it shall be signed by the registered The City of the business name, or by the registered The City's authorized officials if The City is a partnership or a corporation.

B8.4.1 The name and official capacity of all individuals signing Form A: Bid shall be printed below such signatures.

B8.4.2 All signatures should be witnessed, except where a corporate seal has been affixed.

B8.5 If a Bid 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 Bid 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.

B9.2 The quantities listed on Form B: Prices are to be considered approximate only. The City will use said quantities for the purpose of comparing Bids.

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.

B10. QUALIFICATION

B10.1 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; 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.

B10.2 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 Branch internet site at http://www.winnipeg.ca/matmgt).

B10.3 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);

B10.4 Further to B10.3(c), the Bidder shall, within three (3) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the

Bidder/Subcontractor has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

(a) a valid COR certification number under the Certificate of Recognition (COR) Program administered by the Manitoba Construction Safety Association or by the Manitoba Heavy Construction Association's Safety, Health and Environment Program; or

(b) a report or letter to that effect from an independent reviewer acceptable to the City. (A list of acceptable reviewers and the review template are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.)

B10.5 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.

B10.6 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.

B11. BID SECURITY

B11.1 The Bidder shall provide bid security in the form of:

(a) a bid bond, in the amount of at least ten percent (10%) of the Total Bid Price, and agreement to bond of a company registered to conduct the business of a surety in Manitoba, in the form included in the Bid Submission (Form G1: Bid Bond and Agreement to Bond); or

(b) an irrevocable standby letter of credit, in the amount of at least ten percent (10%) of the Total Bid Price, and undertaking issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form included in the Bid Submission (Form G2: Irrevocable Standby Letter of Credit and Undertaking); or

(c) a certified cheque or draft payable to "The City of Winnipeg", in the amount of at least fifty percent (50%) of the Total Bid Price, drawn on a bank or other financial institution registered to conduct business in Manitoba.

B11.1.1 If the Bidder submits alternative bids, the bid security shall be in the amount of the specified percentage of the highest Total Bid Price submitted.

B11.1.2 All signatures on bid securities shall be original, and shall be witnessed or sealed as required.

B11.2 The bid security of the successful Bidder and the next two lowest evaluated responsive and responsible Bidders will be released by the City when a Contract for the Work has been duly executed by the successful Bidder and the performance security furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

B11.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B11.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.

B11.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

B11.3 The bid securities of all Bidders will be released by the City as soon as practicable following notification by the Contract Administrator to the Bidders that no award of Contract will be made pursuant to the Bid Opportunity.

B12. OPENING OF BIDS AND RELEASE OF INFORMATION

B12.1 Bids will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Branch, or in such other office as may be designated by the Manager of Materials.

B12.1.1 Bidders or their representatives may attend.

B12.1.2 Bids determined by the Manager of Materials, or his designate, to not include the bid security specified in B11 will not be read out.

B12.2 Following the submission deadline, the names of the Bidders and their Total Bid Prices (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B12.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract Amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B12.4 The Bidder is advised that any information contained in any Bid 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.

B13. IRREVOCABLE BID

B13.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.

B13.2 The acceptance by the City of any Bid shall not release the Bids of the next two lowest evaluated responsive Bidders and these Bidders shall be bound by their Bids on such Work until a Contract for the Work has been duly executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid.

B14. WITHDRAWAL OF BIDS

B14.1 A Bidder may withdraw his Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.

B14.1.1 Notwithstanding C23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.

B14.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid, and only such person, has authority to give notice of withdrawal.

B14.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials will:

(a) retain the Bid until after the Submission Deadline has elapsed;

(b) open the Bid to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid; and

(c) if the notice has been given by any one of the persons specified in B14.1.3(b), declare the Bid withdrawn.

B14.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B13.2 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, including the right to retain the Bidder's bid security.

B15. EVALUATION OF BIDS

B15.1 Award of the Contract shall be based on the following bid evaluation criteria:

(a) compliance by the Bidder with the requirements of the Bid Opportunity (pass/fail);

(b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B10 (pass/fail);

(c) Total Bid Price;

(d) economic analysis of any approved alternative pursuant to B6.

B15.2 Further to B15.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements or minor informalities or irregularities, if the interests of the City so require.

B15.3 Further to B15.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his Bid or in other information required to be submitted, that he is responsible and qualified.

B15.4 Further to B15.1(c), the Evaluated Bid Price shall be the sum of the quantities multiplied by the unit prices for each item shown on Form B: Prices.

B15.4.1 If there is any discrepancy between the Total Bid Price written in figures, the Total Bid Price written in words and the sum of the quantities multiplied by the unit prices for each item, the sum of the quantities multiplied by the unit prices for each item shall take precedence.

B16. AWARD OF CONTRACT

B16.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B16.2 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 Bids are determined to be responsive.

B16.2.1 Without limiting the generality of B16.2, 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 Bid 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.

B16.3 Subject to B16.2, where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid.

B16.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of his Bid upon written request to the Contract Administrator.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

C0.1 The *General Conditions for Construction* (Revision 2006 12 15) are applicable to the Work of the Contract.

C0.1.1 The *General Conditions for Construction* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

C0.2 A reference in the Bid Opportunity to a section, clause or subclause with the prefix "**C**" designates a section, clause or subclause in the *General Conditions for Construction*.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of construction of a wastewater pumping station, complete with mechanical equipment and electrical fixtures.

D2.2 The major components of the Work are as follows:

(a) excavation and shoring.

(b) cast-in-place concrete floor slabs at and below ground level.

(c) cast-in-place concrete walls below ground level.

(d) masonry block and brick cavity wall pump house with metal roof.

(e) mechanical pumping equipment, piping systems, and related accessories.

(f) safety lighting and associated electrical accessories.

(g) ventilation system and accessories.

(h) wastewater sewer inlet pipe, force main and water service.

(i) landscaping.

(j) site restoration and clean up.

D3. CONTRACT ADMINISTRATOR

D3.1 The Contract Administrator is MMM Group, represented by:

Grantley King, P.Eng.
Structural Engineer
Suite 111-93 Lombard Ave

Telephone No. (204) 943-3178
Facsimile No. (204) 943-4948

D3.2 At the pre-construction meeting, the Contract Administrator will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D4. CONTRACTOR'S SUPERVISOR

D4.1 At the pre-construction meeting, the Contractor shall identify his designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D5. NOTICES

D5.1 Except as provided for in C23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.

D5.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D5.3, D5.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D3.1.

D5.3 All notices of appeal to the Chief Administrative Officer shall be sent to the following address or facsimile number:

The City of Winnipeg
Chief Administrative Officer Secretariat
Attn: Chief Administrative Officer
Administration Building, 3rd Floor
510 Main Street
Winnipeg MB R3B 1B9

Facsimile No.: (204) 949-1174

D5.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:

The City of Winnipeg
Corporate Services Department
Legal Services Division
Attn: City Solicitor
185 King Street, 3rd Floor
Winnipeg MB R3B 1J1

Facsimile No.: (204) 947-9155

D6. FURNISHING OF DOCUMENTS

D6.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

SUBMISSIONS

D7. AUTHORITY TO CARRY ON BUSINESS

D7.1 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.

D8. SAFE WORK PLAN

D8.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D8.2 The Safe Work Plan should be prepared and submitted in the format shown in the City's template which is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

D9. INSURANCE

D9.1 The Contractor shall provide and maintain the following insurance coverage:

(a) commercial general liability insurance, in the amount of at least two million dollars ($2,000,000.00) inclusive, with The City of Winnipeg added as an additional insured, with a cross-liability clause, such liability policy to also contain contractual liability, unlicensed motor vehicle liability, non-owned automobile liability and products and completed operations, to remain in place at all times during the performance of the Work and throughout the warranty period;

(b) automobile liability insurance for owned automobiles used for or in connection with the Work in the amount of at least two million dollars ($2,000,000.00) at all times during the performance of the Work and until the date of Total Performance;

(c) an all risks Installation Floater carrying adequate limits to cover all machinery, equipment, supplies, and/or materials intended to enter into and form part of any installation.

D9.2 Deductibles shall be borne by the Contractor.

D9.3 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in C4.1 for the return of the executed Contract.

D9.4 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least fifteen (15) Calendar Days prior written notice to the Contract Administrator.

D10. PERFORMANCE SECURITY

D10.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:

(a) a performance bond of a company registered to conduct the business of a surety in Manitoba, in the form attached to these Supplemental Conditions (Form H1: Performance Bond), in the amount of fifty percent (50%) of the Contract Price; or

(b) an irrevocable standby letter of credit issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form attached to these Supplemental Conditions (Form H2: Irrevocable Standby Letter of Credit), in the amount of fifty percent (50%) of the Contract Price; or

(c) a certified cheque or draft payable to “The City of Winnipeg”, drawn on a bank or other financial institution registered to conduct business in Manitoba, in the amount of fifty percent (50%) of the Contract Price.

D10.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.

D10.2 If the bid security provided in his Bid was not a certified cheque or draft pursuant to B11.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D11. DETAILED PRICES

D11.1 The Contractor shall provide the Contract Administrator with a detailed price breakdown (Form I: Detailed Prices) at least two (2) Business Days prior to the commencement of any Work on

the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D11.2 The Contractor shall state a price for each item or sub-item of the Work identified on Form I: Detailed Prices. The detailed prices must be consistent with the price(s) provided in the Contractor's Bid.

D12. SUBCONTRACTOR LIST

D12.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D13. DETAILED WORK SCHEDULE

D13.1 The Contractor shall provide the Contract Administrator with a detailed work schedule at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D13.2 The detailed work schedule shall consist of the following:

(a) a Gantt chart for the Work acceptable to the Contract Administrator.

D13.3 Further to D13.2 (a), the Gantt chart shall clearly identify the start and completion dates of all of the following activities/tasks making up the Work as well as showing those activities/tasks on the critical path:

(a) Mobilization.

(b) Excavation and shoring.

(c) Pump floor and wet well concrete slab.

(d) Concrete walls.

(e) Pump house concrete floor slab.

(f) Wastewater inlet sewer

(g) Forcemain.

(h) Water service

(i) Stairs.

(j) Pumping Station superstructure, including finishing.

(k) Miscellaneous metal fabrications (hatches, ladders, guard rails, etc.).

(l) Swing arm hoist (main floor).

(m) Installation of all mechanical equipment, including wastewater pumps, suction and discharge piping, inlet valve, site tube, sump pump and ventilation.

(n) Ventilation equipment

(o) Substantial Performance.

(p) Landscaping.

(q) Site clean-up and restoration.

(r) Total Performance.

SCHEDULE OF WORK

D14. COMMENCEMENT

D14.1 The Contractor shall not commence any Work until he is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D14.2 The Contractor shall not commence any Work on the Site until:

(a) the Contract Administrator has confirmed receipt and approval of:

(i) evidence of authority to carry on business specified in D7;

(ii) evidence of the workers compensation coverage specified in C6.15;

(iii) the Safe Work Plan specified in D8;

(iv) evidence of the insurance specified in D9;

(v) the performance security specified in D10;

(vi) the detailed prices specified in D11;

(vii) the Subcontractor list specified in D12;

(viii) the detailed work schedule specified in D13; and

(b) the Contractor has attended a pre-construction meeting with the Contract Administrator, or the Contract Administrator has waived the requirement for a pre-construction meeting.

D14.3 The Contractor shall commence the Work on the Site within seven (7) Working Days of receipt of the letter of intent.

D14.4 The City intends to award this Contract by March 31, 2008.

D14.4.1 If the actual date of award is later than the intended date, the dates specified for Commencement, Substantial Performance, and Total Performance will be adjusted by the difference between the aforementioned intended and actual dates.

D15. SUBSTANTIAL PERFORMANCE

D15.1 The Contractor shall achieve Substantial Performance by August 31, 2008.

D15.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D15.3 The date on which the Work has been certified by the Contract Administrator as being substantially performed to the requirements of the Contract through the issue of a certificate of Substantial Performance is the date on which Substantial Performance has been achieved.

D16. TOTAL PERFORMANCE

D16.1 The Contractor shall achieve Total Performance by September 30, 2008.

D16.2 When the Contractor or the Contract Administrator considers the Work to be totally performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Total Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D16.3 The date on which the Work has been certified by the Contract Administrator as being totally performed to the requirements of the Contract through the issue of a certificate of Total Performance is the date on which Total Performance has been achieved.

D17. LIQUIDATED DAMAGES

D17.1 If the Contractor fails to achieve Substantial Performance or Total Performance in accordance with the Contract by the dates fixed herein for Substantial Performance and Total Performance, the Contractor shall pay the City the following amounts per Calendar Day for each and every Calendar Day following the dates fixed herein for Substantial Performance and Total Performance during which such failure continues.

(a) Substantial Performance – one thousand dollars ($1000.00)

(b) Total Performance - one thousand dollars ($1000.00)

D17.2 The amount specified for liquidated damages in D17.1 is based on a genuine pre-estimate of the City's damages in the event that the Contractor does not achieve Substantial Performance and Total Performance by the day fixed herein for same.

D17.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D18. SCHEDULED MAINTENANCE

D18.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:

(a) Watering, weed control, cutting of grass, and tending to trees and shrubs, until established as specified in E8 and E9.;

D18.2 Determination of Substantial Performance and Total Performance shall be exclusive of scheduled maintenance identified herein. All scheduled maintenance shall be completed prior to the expiration of the warranty period. Where the scheduled maintenance cannot be completed during the warranty period, the warranty period shall be extended for such period of time as it takes the Contractor to complete the scheduled maintenance.

CONTROL OF WORK

D19. JOB MEETINGS

D19.1 Regular weekly job meetings will be held at the Site. These meetings shall be attended by a minimum of one representative of the Contract Administrator, one representative of the City and one representative of the Contractor. Each representative shall be a responsible person capable of expressing the position of the Contract Administrator, the City and the Contractor respectively on any matter discussed at the meeting including the Work schedule and the need to make any revisions to the Work schedule. The progress of the Work will be reviewed at each of these meetings.

D19.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he deems it necessary.

D20. OFFICE FACILITIES

D20.1 The Contractor shall supply office facilities for the Contract Administrator meeting the following requirements:

(a) Conveniently located at or near the job site.

(b) Minimum floor area of 20 square metres, with windows and a door entrance complete with suitable lock satisfactory to the Contract Administrator.

(c) Suitable for all-weather use and capable of maintaining a temperature range between 20 and 25 degrees C.

(d) Equipped with fluorescent lights and 120 volt ac electrical wall outlets

(e) One holding tank toilet to be provided.

(f) Furnished with one desk, one drafting table, one filing cabinet and six chairs, all satisfactory to the Contract Administrator.

(g) All of the temporary structures provided by the Contractor for this project shall be stabilized in a sufficient manner to prevent the temporary structure from being overturned by wind forces as defined in the National Building Code (NBC). The stabilization provided shall be designed by a Professional Engineer registered in the Province of Manitoba. Detailed drawings and design notes for the stabilization works bearing the Engineer's seal shall be provided to the Contract Administrator for review.

The Contractor shall be responsible for installation, maintenance, removal, operating costs, and service installation costs for the field office as described herein.

D21. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D21.1 Further to C6.24, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

D22. TRAFFIC CONTROL AND MAINTENANCE OF ACCESS

D22.1 Traffic control shall be carried out in accordance with Section 3.7 of CW 1130

D22.2 Further to D19.1, should the Contract Administrator require that Work on Regional Streets be carried out at night, on Sundays, on public holidays or that Work be restricted or suspended during peak traffic hours, the Contractor shall comply without additional compensation being considered to meet these requirements.

D22.3 Regional Streets in this Contract are:

(a) Dugald Road

D22.4 Construction activities on Regional Streets shall be restricted to the closed lanes between 07:00 to 09:00 hours and 15:0 to 17:30 hours Monday to Friday and other hours as directed by the Contract Administrator.

D22.5 The Contractor will have access to the open lanes of traffic during non-restricted hours provided flag person are used in accordance with Section 3.12 of The City of Winnipeg, "Manual of Temporary Traffic Control in Work Areas on City Streets" to maintain traffic safety.

D22.6 Further to Section 3.6 of CW 1130, the Contractor shall maintain safe pedestrian crossing at intersections at all times. If possible, only one pedestrian crossing is blocked by construction at an intersection at the same time the Contractor shall provide flag persons to safely escort pedestrians across the intersection. The Contractor shall leave pedestrian crossing location safe and free of equipment that many hamper pedestrians when no construction activities are ping performed at a particular crossing location.

D22.7 The Contractor shall not park company or private vehicles inside the barricaded work zone in a manner that will block sightlines for vehicles and pedestrians approaching and crossing intersections.

D22.8 Buss traffic is to be maintained at all times.

MEASUREMENT AND PAYMENT

D23. PAYMENT

D23.1 Further to C12, effective January 1, 2007 the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

D24. PAYMENT SCHEDULE

D24.1 Further to C12, payment shall be in accordance with the following payment schedule:

(a) Payment shall be pro rated against the Unit Bid Prices based on percentage completion of each of the items of work identified on Form B: Prices, including percentage completion of major items of work identified on Form I: Detailed Prices.

WARRANTY

D25. WARRANTY

D25.1 Notwithstanding C13.2, the warranty period shall begin on the date of Total Performance and shall expire two (2) year thereafter, except where longer warranty periods are specified in respective Specification sections, unless extended pursuant to C13.2.1 or C13.2.2, in which case it shall expire when provided for thereunder.

FORM H1: PERFORMANCE BOND
(See D10)

KNOW ALL MEN BY THESE PRESENTS THAT

_____
(hereinafter called the "Principal"), and

_____ ,
(hereinafter called the "Surety"), are held and firmly bound unto **THE CITY OF WINNIPEG** (hereinafter called the "Obligee"), in the sum of

_____

_____ dollars ($_____.____)

of lawful money of Canada to be paid to the Obligee, or its successors or assigns, for the payment of which sum the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Principal has entered into a written contract with the Obligee dated the

_____ day of _____ , 20____ , for:

BID OPPORTUNITY NO. 892-2007

DUGALD ROAD WASTEWATER PUMPING STATION

which is by reference made part hereof and is hereinafter referred to as the “Contract”.

NOW THEREFORE the condition of the above obligation is such that if the Principal shall:

(a) carry out and perform the Contract and every part thereof in the manner and within the times set forth in the Contract and in accordance with the terms and conditions specified in the Contract;
(b) perform the Work in a good, proper, workmanlike manner;
(c) make all the payments whether to the Obligee or to others as therein provided;
(d) in every other respect comply with the conditions and perform the covenants contained in the Contract; and
(e) indemnify and save harmless the Obligee against and from all loss, costs, damages, claims, and demands of every description as set forth in the Contract, and from all penalties, assessments, claims, actions for loss, damages or compensation whether arising under "The Workers Compensation Act", or any other Act or otherwise arising out of or in any way connected with the performance or non-performance of the Contract or any part thereof during the term of the Contract and the warranty period provided for therein;

THEN THIS OBLIGATION SHALL BE VOID, but otherwise shall remain in full force and effect. The Surety shall not, however, be liable for a greater sum than the sum specified above.

AND IT IS HEREBY DECLARED AND AGREED that the Surety shall be liable as Principal, and that nothing of any kind or matter whatsoever that will not discharge the Principal shall operate as a discharge or release of liability of the Surety, any law or usage relating to the liability of Sureties to the contrary notwithstanding.

IN WITNESS WHEREOF the Principal and Surety have signed and sealed this bond the

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

By: _____ (Seal)
(Attorney-in-Fact)

FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT
(PERFORMANCE SECURITY)
(See D10)

_____
(Date)

The City of Winnipeg
Corporate Services Department
Legal Services Division
185 King Street, 3rd Floor
Winnipeg MB R3B 1J1

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 892-2007

DUGALD ROAD WASTEWATER PUMPING STATION

Pursuant to the request of and for the account of our customer,

_____ ,
(Name of Contractor)

_____
(Address of Contractor)

WE HEREBY ESTABLISH in your favour our irrevocable Standby Letter of Credit for a sum not exceeding in the aggregate

_____

_____ Canadian dollars.

This Standby Letter of Credit may be drawn on by you at any time and from time to time upon written demand for payment made upon us by you. It is understood that we are obligated under this Standby Letter of Credit for the payment of monies only and we hereby agree that we shall honour your demand for payment without inquiring whether you have a right as between yourself and our customer to make such demand and without recognizing any claim of our customer or objection by the customer to payment by us.

The amount of this Standby Letter of Credit may be reduced from time to time only by amounts drawn upon it by you or by formal notice in writing given to us by you if you desire such reduction or are willing that it be made.

Partial drawings are permitted.

We engage with you that all demands for payment made within the terms and currency of this Standby Letter of Credit will be duly honoured if presented to us at:

_____
(Address)

and we confirm and hereby undertake to ensure that all demands for payment will be duly honoured by us.

All demands for payment shall specifically state that they are drawn under this Standby Letter of Credit.

Subject to the condition hereinafter set forth, this Standby Letter of Credit will expire on

_____ .
(Date)

It is a condition of this Standby Letter of Credit that it shall be deemed to be automatically extended from year to year without amendment from the present or any future expiry date, unless at least 30 days prior to the present or any future expiry date, we notify you in writing that we elect not to consider this Standby Letter of Credit to be renewable for any additional period.

This Standby Letter of Credit may not be revoked or amended without your prior written approval.

This credit is subject to the Uniform Customs and Practice for Documentary Credit (1993 Revision), International Chamber of Commerce Publication Number 500.

_____
(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

FORM I: DETAILED PRICES
(See D11)

DUGALD ROAD WASTEWATER PUMPING STATION

ITEM NO.	DESCRIPTION	AMOUNT
1.	Mobilization & Demobilization	
2.	Excavation and shoring	
3.	Backfilling	
4.	Mixing and placing cast-in-place concrete: a. Pump floor and wet well floor slab b. Walls c. Pumping station floor slab and wet well roof slab	
5.	Stairs and Catwalks	
6.	Pumping station superstructure, including finishing	
7.	Transformer pad and pile	
8.	Miscellaneous metal fabrications (hatches, ladders, guard rails, etc).	
9.	Swivel beam and electric hoist (main floor)	
10.	Installation of all mechanical equipment, including wastewater pumps, suction and discharge piping, inlet valve, sight tube, sump pump, water piping, and ventilation.	
11.	Lifting beam and manual hoist (pump room)	
12.	Landscaping	
13.	Electrical	
14.	Ventilation	
Total of Items 1 thru 14 above = Bid Price for Items 1 thru 9 on Form B: Prices.		

FORM J: SUBCONTRACTOR LIST
(See D12)

DUGALD ROAD WASTEWATER PUMPING STATION

Name	Address

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS AND DRAWINGS

E1.1 These Specifications shall apply to the Work.

E1.2 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.

E1.2.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

E1.2.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.

E1.2.3 Further to C2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.

E1.3 The following are applicable to the Work:

Drawing No.	Drawing Name/Title
	Cover Sheet
7500	Site Plan – Underground Services
7501	Main Floor and Roof Plan
7502	Roof Framing Plan and Notes
7503	Building Elevations and Sections
7504	Sections and Details
7505	Electrical Layout and Notes
7506	Landscape Plan
7507	Mechanical Layout and Notes
7508	Concrete Plan
7509	Structural Wall Elevations
7510	Structural Reinforcing Details
7511	Miscellaneous Structural Details
7598	Mechanical Piping Section Views
7599	Mechanical Piping Plan Views and Details

E2. SOILS INVESTIGATION REPORT

E2.1 Further to C3.1, Further to C3.1, of the General Conditions, a geotechnical soil investigation has been carried out by in the vicinity of the proposed Works to determine the character of the subsurface soil to facilitate the design of the Work. The information is considered accurate at the locations indicated and at the time of the investigation. However, considerable variations in

the soil conditions may exist between test holes and fluctuations in the ground water levels can be expected seasonally. A copy of the geotechnical report dated August 15, 2007, is included in Appendix A at the end of these Specifications for the convenience of Bidders.

E2.2 Bidders are responsible for any interpretation they place on the supplied information and are expected to make any additional investigation of the soil, as they feel necessary.

E2.3 Any test borings made by the Bidder shall be done in accordance with the requirements of the appropriate authorities of the City of Winnipeg. Bidders shall notify the Contract Administrator prior to starting any soil boring operation.

E3. TEMPORARY USE OF CITY EQUIPMENT

E3.1 City systems and equipment shall not be used during construction without the Contract Administrator's written permission. The Contract Administrator reserves the right to withdraw said permission if, in his opinion, proper care and maintenance are not provided.

E4. MOBILIZATION AND DEMOBILIZATION

E4.1 Mobilization and Demobilization will include but not be limited to start-up costs, equipment set-up and removal, field office and storage facilities set-up and removal site cleanup.

E4.2 Mobilization and Demobilization will be measured on a unit basis and paid for at the Contract Unit Price for " Mobilization and Demobilization" in accordance with this specification, accepted and measured by the Contract Administrator.

E4.3 50% of the Mobilization and Demobilization unit price will be paid on the first progress payment.

E4.4 The remaining 50% of the Mobilization and Demobilization unit price will be paid subsequent to the completion of the work and restoration and clean-up of the site.

E5. DANGEROUS WORK CONDITIONS

E5.1 Further to clause C 6.26 of the General Conditions, the Contractor shall be aware that pumping stations, underground chambers, manholes, and sewers are considered a confined space and shall follow the "Guidelines for Confined Entry Work" as published by the Manitoba Workplace Safety and Health Division.

E5.2 The Contractor shall be aware of the potential hazards that can be encountered in a wastewater pumping station such as explosive gases, toxic gases, and oxygen deficiency.

E5.3 The air in a confined space must be tested before entry and continuously during the time that personnel are inside the space. Equipment for continuous monitoring of gases must be explosion-proof and equipped with a visible and audible alarm. The principal tests are for oxygen deficiency, explosion range and toxic gases. Testing equipment must be calibrated in accordance with manufacturer's specifications.

E5.4 The Contractor must ventilate all confined spaces at least 15 minutes prior to entry and continue while the confined space is occupied, and as approved by the Manitoba Workplace Safety and Health Act. If no ventilation is supplied, the worker must wear a respirator or supplied air to enter the confined space.

E5.5 The Contractor shall provide photoionization detector (PID) on site at all times to monitor potential hydrocarbon vapours in the confined spaces. The gas detector(s) and safety equipment conforming to the Manitoba Workplace Safety and Health Act shall be made available to the Contract Administrator for his use during inspection. In addition, the Contract Administrator shall collect discrete air samples for laboratory analysis.

E5.6 The Contract Administrator may issue a Stop Work Order to the Contractor if he determines the above guidelines are not being followed. The Contractor shall not resume his operations until

the Contract Administrator is satisfied the Contractor is following the appropriate procedures. The Contractor shall have no claim for extra time or costs due to Stop Work Order for not following these safety guidelines.

E6. SHOP DRAWINGS

E6.1 Description

(a) This Specification shall revise, amend, and supplement the requirements of CW 1100.

(i) The term 'shop drawings' means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data including site erection drawings which are to be provided by the Contractor to illustrate details of a portion of the Work.

(ii) The Contractor shall submit specified shop drawings to the Contract Administrator for review. All submissions must be in metric units. Where data is in imperial units, the correct metric equivalent shall also be show on all submissions for Engineering review.

(b) Shop Drawings

(i) Original drawings are to be prepared by the Contractor, Subcontractor, supplier, distributor, or manufacturer, which illustrate appropriate portion of work; showing fabrication, layout, setting or erection details as specified in appropriate sections.

(ii) Shop drawings for the following structural components shall be sealed, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba.

(a) Excavation and shoring

(b) Reinforcing steel.

(c) Metal fabrications.

(d) Structural connection details.

(c) Contractor's Responsibilities

(i) Review shop drawings, product data and samples prior to submission and stamp and sign drawings indicating conformance to the Contract requirements.

(ii) Verify:

(a) Field measurements.

(b) Field construction criteria.

(c) Catalogue numbers and similar data.

(iii) Coordinate each submission with requirements of work and Contract Documents. Individual shop drawings will not be reviewed until all related drawings are available.

(iv) Notify Contract Administrator, in writing at time of submission, of deviations from requirements of Contract Documents.

(v) Responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator's review of submission, unless Contract Administrator gives written acceptance of specified deviations.

(vi) Responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.

(vii) The Contractor shall make all corrections required by the Contract Administrator and shall resubmit the required number of corrected copies of Shop Drawings for review. 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.

(viii) After the Contract Administrator has reviewed and return of copies, distribute copies to sub-trades as appropriate.

(ix) Maintain one (1) complete set of reviewed shop drawings, filed by Specification Section Number, at the site of the work for use and reference of the Contract Administrator and Subcontractors.

(d) Submission Requirements

(i) Schedule submissions at least 14 Calendar days before dates reviewed submissions will be needed, and allow for a 14 Calendar day period for review by the Contract Administrator of each individual submission and re-submission, unless noted otherwise in the Contract Documents.

(ii) Submit five (5) paper prints of shop drawings. The Contractor is advised that the Contract Administrator will retain three (3) copies of all submittals and return two (2) copies to the Contractor.

(iii) Accompany submissions with transmittal letter, containing:

(a) Date.

(b) Project title and Bid Opportunity number.

(c) Contractor's name and address.

(d) Number of each shop drawing, product data, and sample submitted.

(e) Specification section, title, number and clause.

(f) Drawing number and detail/section number.

(g) Other pertinent data.

(iv) Submissions shall include:

(a) Date and revision dates.

(b) Project title and bid opportunity number.

(c) Name of:

(i) Contractor

(ii) Subcontractor

(iii) Supplier

(iv) Manufacturer

(v) Separate detailer when pertinent

(d) Identification of product of material.

(e) Relation to adjacent structure or materials.

(f) Field dimensions, clearly identified as such.

(g) Specification section name, number and clause number or drawing number and detail/section number.

(h) Applicable standards, such as CSA or CGSB numbers.

(i) Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements, and compliance with contract documents.

(e) Other Considerations

(i) Fabrication, erection, installation or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent shop drawings and resubmit.

(ii) Material and equipment delivered to the site of the works will not be paid for at least until pertinent shop drawings have been submitted and reviewed.

(iii) Incomplete shop drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.

(iv) No delay or cost claims will be allowed that arise because of delays in submissions, re-submissions, and review of shop drawings.

(v) If the Contract Administrator requests details or items on shop drawings, which the Contractor believes, require extra payment or contract time, the Contractor shall make any claims forthwith and receive acceptance, as extra work, or rejection, before fabrication proceeds.

E6.2 Measurement and Payment

(a) Preparation, submission, and revisions of shop drawings shall be incidental to the Work and no separate payment will be made

E7. PROTECTION OF EXISTING TREES

E7.1 The City of Winnipeg, Public Works, Forestry Branch will remove all trees and bush from the site within the limits indicated on the Drawings and prior to the commencement of the Work.

E7.2 The Contractor shall not remove or damage trees or bush beyond the limits indicated on the Drawings. The Contractor shall take the following precautionary steps to avoid damage from his construction activities to existing trees within the limits of the construction area.

(a) Do not stockpile materials and soil or park vehicles and equipment on boulevards within 2 metres of trees.

(b) Strap mature tree trunks with 25 x 150 x 2400 wood planks. Smaller trees shall be similarly protected using appropriate sized wood planks.

(c) Excavations shall be carried out in a manner to minimize damage to existing root systems. Where roots must be cut to facilitate an excavation they shall be neatly pruned at the face of the excavation.

(d) Work on site shall be carried out in a manner to minimize damage to existing tree branches. Where damage to tree branches does occur, the Contractor shall neatly prune the damaged branch.

(e) American elm trees shall not be pruned between April 1st and August 1st and Siberian elm trees between April 1st and July 1st of any year under provisions of The Dutch Elm Disease Act.

(f) All damages to existing trees due to the Contractor's construction activities shall be repaired to the requirements and satisfaction of the City of Winnipeg, Parks and Recreation Department, Forestry Branch.

(g) Protection of existing trees and related Work specified herein shall be considered incidental to the Contract Lump Sum Price for “Landscaping”, and no separate measurement or payment will be made.

E8. LANDSCAPING

E8.1 Description

(a) This specification shall cover the supply and installation of trees, shrubs, sod and removal of existing trees.

(b) The Work to be done by the Contractor under this Specification shall include the furnishing of all labour, materials, equipment and services necessary for and incidental to the satisfactory performance and completion of all Work as hereinafter specified and as shown on the Drawings.

E8.2 References and Related Specifications

(a) All related specifications shall be current issue or latest revision at the first date of Bid Opportunity advertised.

(b) Related Specifications

(i) Clearing and Grubbing CW 3010

(ii)	Topsoil and Finish Grade for the Establishment of Turf Areas	CW 3540
(iii)	Sodding	CW 3510

E8.3 Materials

E8.3.1 Water

(a) Use water which is potable and free of minerals that may be detrimental to plant growth.

E8.3.2 Wood Chip Mulch

(a) Wood Chip Mulch pieces shall be no longer than 125mm in any one direction.

(b) Wood Chip Mulch shall be locally supplied from tree specimens free from disease and fungus.

(c) Wood Chip Mulch shall not contain soil, stone or any other deleterious material.

E8.3.3 Planting Soil

(a) As specified in CW 3540

E8.3.4 Sod

(a) As specified in CW 3510

E8.3.5 Root Ball Burlap

(a) Root ball burlap is to be 150 g Hessian burlap, biodegradable.

E8.3.6 Wire Baskets

(a) Wire baskets are to be a horticultural accepted product designed to carry the weight and to contain a burlap-covered root ball.

(b) Minimum diameter basket size is to conform to the same minimum diameter of the tree root ball for the respective minimum tree calliper sizes.

E8.3.7 Fertilizer

(a) Fertilizer shall be standard commercial brands meeting the requirements of the Canada Fertilizer Act and the Canadian Fertilizer Quality Assurance Program.

(b) Fertilizer is to be a slow release formulation of low nitrogen and high phosphorus e.g. 10-50-12.

(c) All fertilizers shall be granular, pelletized or pill form, and shall be dry and free flowing.

(d) Apply quantities at rates stated by product manufacturer.

E8.3.8 Source Quality Control

(a) The Contractor shall inform the Contract Administrator of the proposed source of plant material to be supplied. The Contract Administrator reserves the right to reject materials not conforming to the requirements of this Specification.

(b) Plant material is to be grown in nurseries under proper cultural practices as recommended by the Canadian Nursery Trades Association.

(c) Only those plants which have been grown in local Manitoba nurseries located in an Agriculture Canada Plant Hardiness Zone designation of 2(a or b) or 3(a or b) and within a 250 kilometre radius of Winnipeg will be accepted. Plants that have been grown in plant hardiness zones 1 and 4 or greater will be rejected.

(d) The Contract Administrator shall notify the contractor at least 24 hours prior to inspection.

E8.3.9 Plant Material

(a) Nomenclature of specified plants is to conform to the International Code of Nomenclature for Cultivated Plants and is to be in accordance with the approved scientific names given in the latest edition of the Standardized Plant Names.

(b) All plants are to be supplied in accordance with the Work of this Contract and shall be inspected by the Contract Administrator at the nursery site.

(c) At the time of inspection, the Contractor shall permanently tag a suitable branch of each plant with a distinct code clearly indicating that the City of Winnipeg Water and Waste Department will be the intended recipient of that tree.

(d) The Contract Administrator must approve the tag and code at least two (2) weeks in advance of their use.

(e) The tag must be kept on the tree at the time of planting, and removed only when authorized in writing by the Contract Administrator.

(f) The Contract Administrator will reject trees that are delivered without their tags intact at the planting site.

(g) Each tag will identify the species of the tree and its calliper at the time when the tag is placed permanently on the tree.

(h) All tree tagging operations will be conducted after Award of Contract to the Contractor.

(i) Plants are to be characteristically developed for their species and structurally sound, well branched, healthy and vigorous and densely foliated when in leaf. The plant is to have a healthy, well developed, fibrous root system which may be verified through a testing procedure that destructively samples one or more randomly selected root balls.

(j) Trees are to have been root pruned regularly, but not later than one growing season prior to arrival on site. The contractor may be required to furnish documentation to the client on their root-pruning program. Trees in excess of 75mm calliper are to have been half pruned during each of two successive growing seasons, the latter at least, on growing season prior to arrival on site.

(k) All parts of the plants, especially the lower branches, are to be moist and show live, green cambium tissue when cut.

(l) Trees are to have only one, sturdy, generally straight and vertical trunk, and a well-balanced crown with fully developed leader.

(m) Plants are to be free of disease, insect infestation, rodent damage, sun scald, frost cracks, abrasions, unhealed scars, scars exceeding 5 cm in diameter, major forks or crooks in the trunk, broken branches, or angled leaders. Plants having the above defects will not be accepted.

(n) Plants having a leader that has developed at a sharp angle to the trunk as a result of pruning or trunk damage will not be accepted.

(o) Plants exhibiting suppressed, weakly developed branches due to competition from other closely spaced trees in the nursery and trees exhibiting dead branches will not be accepted.

(p) Any tree that has come out of dormant stage and is too far advanced will not be accepted unless prior approval is obtained. Approval is required for any tree which has been held in cold storage.

(q) Balled and burlapped trees in excess of a 3m height must have been dug with large firm ball. Roots in root balls must be comprised of 75% fibrous and feeder root systems. Secure root balls with burlap, heavy twine and rope. For trees 75mm or more in calliper, wrap ball in double layer of burlap and drum lace with minimum 10mm diameter rope. Protect root balls against sudden changes in temperature and exposure to heavy rainfall.

(r) Tree spade dug trees are to be dug with mechanized digging equipment with hydraulic spade. Lift root ball from hole, place in wire basket designed for purpose and lined with burlap. Tie basket to ball with minimum 10mm diameter rope. Trunks that are injured by this process will not be accepted.

(s) Use of collected or native plants is not permitted.

E8.3.10 Plant Quantity and Size

(a) Trees and shrubs are to be planted at the quantities and sizes listed on Plant List (Table E8.3.10). Contractor to ensure that Table E8.3.10 Plant List matches the Plant List on drawings, and will notify the Contract Administrator of any discrepancies.

(b) Any variations to species, size or calliper of specified plants will require a request for approval from the Contract Administrator.

(c) Any changes in planting locations will be determined on-site by the Contract Administrator.

(d) Plants are to conform to the measurements specified in the Plant List, except that trees larger than specified may be used if approved by the Contract Administrator.

(e) Trees are to be measured when the branches are in their normal position. Height dimensions specified refer to the main body of the tree, not from branch tip to root base. Where trees have been measured by calliper or diameter, reference is to be made to the diameter of the trunk measured 15cm above the ground as the tree stands in the nursery prior to lifting. Calliper of tree shall be appropriately designated on a permanently fixed tag on one of the branches.

Table E8.3.10 - Plant List:

QUANTITY	COMMON NAME / BOTANICAL NAME	SIZE AND REMARKS
SHRUBS		
4	Golden Variegated Dogwood / *Cornus alba 'Gouchaultii'*	Min. 450mm ht., min. 5 major basal stems, dense bushy plants, container.
10	Dwarf Bush Honeysuckle / *Diervilla trifida*	Min. 300mm ht., min. 5 major basal stems, dense bushy plants, container.
6	Dwarf Ninebark / *Physocarpus opulifolius 'Dwarf'*	Min. 300mm ht., min. 5 major basal stems, dense bushy plants, container.
8	Abbotswood Potentilla / *Potentilla fruticosa 'Abbotswood'*	Min. 300mm ht., min. 5 major basal stems, dense bushy plants, container.
4	Golden Flowering Currant / *Ribes aureum*	Min. 450mm ht., min. 5 major basal stems, dense bushy plants, container.
3	Dwarf European Cranberry / *Viburnum opulus 'Nanus'*	Min. 300mm ht., min. 5 major basal stems, dense bushy plants, container.

E8.3.11 Shipment and Pre-Planting Care

(a) Coordinate shipping of plants and excavation of holes to ensure a maximum of ten (10) days time between digging and planting.

(b) Tie branches of trees securely, and protect trees against abrasion, exposure and extreme temperature change during transit. Avoid binding of trees with rope or wire, which would damage bark, break branches or destroy natural shape of tree. Give full support to root ball of trees during lifting.

(c) Cover plant foliage with tarpaulin, and protect bare roots by means of dampened straw, peat moss, saw dust or other acceptable material to prevent loss of moisture during transit and storage.

(d) Remove broken and damaged roots with sharp pruning shears. Make clean cuts, and cover cuts over 10 mm diameter with a wound dressing.

(e) Keep roots moist and protected from sun and wind. Heel-in plants which cannot be planted immediately in shaded areas and water well.

E8.4 Construction Methods

E8.4.1 Workmanship

(a) Plant deciduous location of trees will be staked out or painted on Site, in accordance with the landscape drawings, by the Contractor. Locations shall be approved by the Contract Administrator prior to installation.

(b) Keep site clean and planting holes drained. Immediately remove soil or debris spilled onto street pavement, grass or sidewalk.

E8.4.2 Planting Time

(a) Plant only under conditions that are conducive to health and physical conditions of trees.

(b) Provide planting schedule to Contract Administrator. Extending planting operations over long period using limited crew will not be accepted.

(c) The Contractor must obtain all above and below ground clearances from all utilities in a timely manner so as not to jeopardize the schedule of the complete planting Contract.

E8.4.3 Excavation

(a) Excavate planting pits as indicated by stakes or paint marks.

(b) Protect bottom of excavations against freezing.

(c) Remove water, which enters excavations prior to planting. Ensure source of water is not ground water or from broken City water main pipe.

E8.4.4 Installation

(a) Planting shall be done during periods of suitable weather conditions and in accordance with locally accepted practice.

(b) Trees and shrubs are to be planted within forty-eight (48) hours of excavation from the nursery.

(c) No pit is to be left open at the end of the Contractor's Work Day. Planting program is to be planned to ensure that all approved trees delivered to the Site at designated planting locations are installed and thoroughly watered the same day as delivery.

(d) Loosen bottom and sides of planting hole to depth of 100 - 150 mm.

(e) Plant trees and shrubs vertically. Orient plants to give best appearance in relation to structure, roads and sidewalks.

(f) Place plants to depth equal to depth they were originally growing in nursery.

(g) With balled and burlapped root balls and root balls in wire baskets, loosen burlap and cut away the top 1/3 without disturbing root ball. Do not pull burlap or rope from under root ball. Non-biodegradable wrapping must be removed.

(h) Tamp planting soil around root system in layers of 150 mm eliminating air voids. Frozen or saturated planting soil is unacceptable. When 2/3 of planting soil has been placed, fill hole with water. After water has completely penetrated into soil, complete backfilling.

E8.4.5 Fertilizing

(a) When planting is completed, give surface of planting saucer dressing of a fertilizer with an N-P-K ratio of 15-30-15 or approved equal in accordance with B6.

Mix fertilizer thoroughly with top layer of planting soil and water in well as per manufacturers specifications.

E8.4.6 Pruning

(a) The Contractor shall provide a person with a Manitoba Certified Arborists Licence for each Work crew or Work Site.

(b) Prune after planting to compensate for loss of roots suffered during transplanting. Postpone pruning of material where heavy bleeding may occur, until in full leaf. Employ clean sharp tools and make cuts flush with main and secondary branch collars, smooth and sloping to prevent accumulation of water.

(c) Remove dead and injured branches and branches that rub causing damage to bark. Trim out crown of trees without changing their natural shape. Do not damage lead branches or remove smaller twigs along main branches.

E8.4.7 Watering

(a) Trees and shrubs are to be watered during the planting procedure as described previously, and once a week thereafter, or more frequently if required, during the growing season.

(b) A complete record is to be kept of each series of waterings for all planted material noting: 1) location, and 2) date of watering. This record shall be sent bi-weekly to the Contract Administrator.

(c) Apply 40 litres of water per 25 mm calliper per application using deep root feeder or low/pressure nozzle and hose. The water stream must not gouge out a hole in the soil and mulch.

E8.5 Replacements

(a) During the Maintenance Period, the Contractor shall remove from Site any plant material that has died or failed to grow satisfactorily as determined by the Contract Administrator and replace with the same as per Specifications within a maximum ten (10) day period from notification.

(b) The Contractor shall extend Maintenance and Warranty on replacement shrub for a period equal to the original Maintenance and Warranty Periods.

(c) The Contractor shall continue such replacement, Maintenance and Warranty until plant is acceptable.

E8.6 Warranty

(a) End-of-warranty inspection will not take place in late fall, or early spring.

(b) The Contract Administrator reserves the right to request material replacement or extend the Contractor's Maintenance responsibilities for an additional one (1) year if, at the end of the two (2) year Warranty Period, leaf development and growth are not sufficient to ensure future survival of the tree or shrub.

E8.7 Measurement and Payment

(a) Supplying and placing of shrubs and sod will be measured on a Unit basis and paid for at the Contract Unit Price for “Landscaping”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E9. LANDSCAPE MAINTENANCE

E9.1 Description

(a) This specification shall cover the maintenance of trees, shrubs and sod from the time of installation and for a period of two years from the date of Total Performance. The Work to be done by the Contractor under this Specification shall include the furnishing of all labour, materials, equipment and services necessary for and incidental to the satisfactory

performance and completion of all Work as hereinafter specified and as shown on the Drawings.

(b) Work shall include:

(i) Spring cleaning
(ii) Fertilizing
(iii) Watering
(iv) Weed Control
(v) Pest and disease control
(vi) Tree support, repair and adjustment
(vii) Pruning
(viii) Winter preparation

E9.1.1 Protection

(a) Prevent damage to fencing, other trees, landscaping, benches, buildings, pavement, surface and underground utility facilities due to maintenance equipment and personnel.

E9.1.2 Maintenance Schedule

(a) The Contractor shall provide a complete written Maintenance schedule to the Contract Administrator prior to the issuing of the Certificate of Substantial Performance.

(b) The Maintenance Schedule shall indicate days of week dedicated to on-site maintenance (weather dependant) subject to random inspection by Contract Administrator.

(c) The Maintenance Schedule shall indicate what maintenance practice will be performed weekly/monthly/seasonally.

(d) All maintenance of trees and shrubs to be supervised by a Manitoba Certified Arborist.

E9.2 General Maintenance

(a) The Contractor shall be responsible for the maintenance of the planted material for a period of 2 years from the date of the Certificate of Total Performance.

(b) For areas planted after September 15th the maintenance period will commence on May 15th of the following year or such date as mutually agreed upon by the Contractor and Contract Administrator.

(c) The Contractor shall replace defective plants within three (3) days of notification by the Contract Administrator.

E9.2.1 Documentation and Reporting

(a) Record in a logbook the operations carried out and any conditions that require attention or monitoring. The arborist shall submit a summary of the information as a monthly report to the Contract Administrator. Conditions requiring attention should be brought to the Contract Administrator's attention immediately.

(b) The contractor should review the site regularly and adjust maintenance operations to suit observed conditions. A Site Maintenance Inspection Form (supplied by the Contract Administrator) should be used to record each site visit. Completed copies of these forms shall be sent to the Contract Administrator biweekly.

(c) Report in writing any major maintenance procedures intended, minimum one week in advance.

E9.2.2 If any damage, dangerous or potentially dangerous situations related to landscape works is observed, the Contractor shall notify the Contract Administrator immediately.

E9.2.3 Failure to Document and Submit

(a) If the Contractor fails to submit a monthly report it shall be assumed the work was not performed for that time period. Payment for Landscape Maintenance shall be reduced by 1/6th for every month a report is not submitted.

E9.2.4 Qualifications

(a) All landscape maintenance personnel shall be skilled in the tasks assigned to them.

E9.2.5 Certificate of Acceptance

(a) The Certificate of Acceptance for landscape works will be issued upon completion of the two (2) year Maintenance Period, provided that trees and shrubs are well established and rooted, properly pruned and showing vigorous growth satisfactory to the Contract Administrator.

(b) Unacceptable trees, shrubs or sod shall be removed and replaced in accordance to the specifications. Maintenance of replacement items shall be extended for a period equal to the original Maintenance Period as specified herein, and in accordance with the inspection requirements.

(c) Replacement and maintenance requirements will continue until the material is accepted.

E9.3 Materials

E9.3.1 Fertilizer

(a) Fertilizer shall be complete synthetic slow release fertilizer with maximum 35% water-soluble nitrogen.

E9.4 Construction Methods

E9.4.1 Spring Cleaning

(a) Remove any dead vegetation, leaves and debris. Heavy raking shall be done with a flexible grass rake on areas with snow mold. Lightly roll areas where grass plants have lifted due to frost action.

E9.4.2 Fertilizing

(a) Soil testing shall be carried out by a recognized testing facility prior to fertilizer application to ensure a properly formulated program.

(b) Fertilizer shall be spread evenly at frequency, ratio and rates as recommended by the Manufacturer. Use approved mechanical spreading equipment. Check calibration to ensure specified rate is spread evenly. Water immediately after fertilizing. Rectify uneven spreading as soon as it becomes apparent.

E9.4.3 Watering – General

(a) Water shall be applied as required to supplement rainfall and to maintain optimum growing conditions. Allow soil to adequately dry between watering to prevent over saturation without creating water stress.

(b) Water shall be applied in a soft spray to avoid packing of soil.

(c) Use of the installed irrigation system is prohibited unless approved by the Contract Administrator.

(d) Do not impede use of sidewalk and other paved areas.

(e) Water every third day for first and second month after planting. Thereafter, water once per week between May 1 and October 15.

E9.4.4 Watering of Trees

(a) A complete record is to be kept of each series of watering for all planted trees noting: 1) location, and 2) date of watering. This record is to be giving to the Contract Administrator when requested.

(b) Apply 40 litres of water per 25 calliper per application using deep root feeder or low-pressure open flow nozzle and hose. The water stream must not gouge out a hole in the soil and mulch.

E9.4.5 Weed Control

(a) Surface shall be maintained free of weeds. Do not allow weeds to establish for a period longer than one (1 week).

(b) Obtain written approval of Contract Administrator prior to using any herbicides.

(c) Do not use dicamba and picloram solutions.

E9.4.6 Pests and Disease Control

(a) Obtain written approval of Contract Administrator prior to using any pesticide.

(b) Control pests and disease through pruning or application of pesticides. Use species-specific pesticides where possible. Use only pesticides of low mammalian toxicity. Strictly follow manufacturer's written instructions.

E9.4.7 Cultivating Planting Beds

(a) Cultivate whenever required to keep top layer of soil, loose, friable and free from weeds. Any operation must be continuous without interruption.

(b) Cultivate surface of planting bed, and soil areas around trees.

(c) Remove weeds including their roots.

(d) Take care not to damage roots of shrubs or flowers. Use small hand tools for areas of closely planted shrubs and/or perennials.

(e) Collect and dispose of paper and refuse. Remove dead plants, leaves, branches, dead flowers and seed pods.

(f) Clean, by hand, areas that are covered with mulch. Loosen top layer of mulch without mixing it with soil underneath.

(g) Add mulch as required to maintain specified thickness.

E9.4.8 Tree Supports and Tie Adjustments

(a) Maintain tree supports and ties in proper repair.

(b) Remove supports and ties as directed by Contractor Administrator.

(c) Straighten any tree that is leaning.

E9.4.9 Tree and Shrub Pruning

(a) The Contractor shall provide a person with a valid Manitoba Arborist’s License for each Work crew or Work Site.

(b) Prune as required to remove dead, broken or damaged limbs. Prune back to healthy growth while maintaining balanced crown shape.

(c) Employ clean sharp tools. Make cuts co-incident with the branch collar near the main stem or branch. Cuts must be smooth and sloping to prevent accumulation of water on cut. Do not leave little stumps ("horns") on trunks or main branches.

E9.4.10 Winter Preparation

(a) Rake and assemble leaves after they have been shed by trees. Remove from site.

(b) Protect plant material from rodent damage using fine wire mesh or approved plastic protector beyond snow line or by applying rodent repellent sprays.

(c) Ensure adequate moisture in root zones of material prior to freeze-up.

(d) Apply anti-desiccant to evergreen trees susceptible to winter desiccation.

E9.5 Measurement and Payment

(a) Maintenance of trees, shrubs and sod will be measured on a Unit basis and paid for at the Contract Unit Price for "Landscaping", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E10. UNDERGROUND SERVICES

E10.1 Description

E10.1.1 General

(a) This specification shall cover the installation of the forcemain, wastewater sewer inlet pipe, water service, vent pipe, and associated items.

E10.1.2 Definitions

(a) The word "forcemain" shall be substituted wherever the word "watermain" appears in Specification CW 2110.

E10.2 Materials

E10.2.1 Pipe

(a) Forcemain pipe shall be in accordance with CW 2110. Pipe size and type shall be as shown on Drawing No. 7598

(b) Vent pipe shall be ASTM D3034, SDR 35 PVC. Pipe size shall be as shown on Drawing No. 7507

(c) Water service shall be in accordance with CW 2110. Pipe size shall be as shown on Drawing No. 7598

E10.2.2 Fittings and Couplings

(a) Fittings and couplings shall be only those products listed as Approved Products for underground use in the City of Winnipeg.

(b) Interference fit flexible rubber boot or gasket insert for PVC pipe connecting to existing concrete manholes shall be in accordance with CW 2130.

E10.2.3 Fasteners, Tie Rods, Clamps, Nuts, and Bolts

(a) Fasteners, tie rods, clamps, nuts, and bolts shall be stainless steel in accordance with CW 2110.

E10.2.4 Bedding

(a) Bedding shall be Class B sand bedding in accordance with CW 2030 and SD-001.

E10.2.5 Backfill

(a) Backfill shall be Class 3 in accordance with CW 2030 and SD-002.

E10.3 Construction Methods

E10.3.1 Forcemain

(a) Install forcemain pipe by trenchless methods as shown on drawings and in accordance with section 3.4 of CW 2110.

(b) Perform hydrostatic leakage test of forcemain to 100 psi (0.7 MPa) in accordance with CW 2125 before connecting to manhole. Disinfection of the forcemain is not required.

(c) Connect forcemain pipe to 200mm diameter pipe stub outside of manhole as shown on drawings and in accordance with Section 3.13 of CW 2110.

E10.3.2 Water Service

(a) Install water service including curb stop from connection at pump station to connect to existing 300mm diameter forcemain with a corporation stop as shown on the Drawings and in accordance with CW 2110.

E10.3.3 Television Inspection

(a) The forcemain and wastewater inlet sewer shall be televised in accordance with CW 2145.

E10.4 Measurement and Payment

E10.4.1 Forcemain

(a) Construction of the forcemain pipe installation, and connection to the 200mm diameter pipe stub outside of the manhole shown on the drawings will be measured on a Unit basis and paid for at the Contract Unit Price for "Forcemain", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

(b) Construction to the 2100 manhole will be measured on a Unit basis and paid for at the Contract Unit Price for "Connection to 2100 Manhole", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E10.4.2 Water Service

(a) Construction of the water service including curb stop, corporation stop and connection of the water service to the 300mm diameter forcemain including corporation stop will be measured on a Unit basis and paid at the Contract Unit Price for "Water Service", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E11. WASTEWATER PUMPING STATION

E11.1 Description

(a) This Specification shall cover the construction of a new reinforced concrete wastewater pumping station as shown on the Drawings.

E11.2 Materials

(a) All materials shall conform to the requirements of this Specification and the requirements of the latest edition of the City of Winnipeg Standard Construction Specification.

(b) Concrete

(i) Concrete mix design shall be as indicated in the Construction Notes on the Drawings and in accordance with Specifications CW 2160 and E12.

(c) Reinforcing Steel

(i) Reinforcing Steel shall conform to Specification CW 2160 and E13.

(d) Metal Fabrications

(i) Metal Fabrications shall conform to E15.

(e) Shop Drawings

(i) Provide shop drawings in accordance with E6 of this specification.

(ii) Submit shop drawings for reinforcing steel a minimum of two (2) weeks prior to the fabrication of any reinforcing steel.

(f) Grout

(i) Grout, if required, shall be Sika Grout 212 or an approved equal, mixed and applied in accordance with the manufacturers instructions and of a consistency suitable for the intended application, as approved by the Contract Administrator.

(g) Backfill

(i) In accordance with CW 2030. Class of backfill to be as shown on the Drawings and as described in E11.

(h) Bonding Agent

(i) The bonding agent, if required, shall be ACRYL-STIX or an approved equal.

(i) Foundation Waterproofing

(i) Foundation waterproofing shall confirm to E14.

(j) Masonry

(i) Masonry shall confirm to E16.

(k) Carpentry

(i) Carpentry shall confirm to E17

(l) Prefabricated Wood Trusses

(i) Prefabricated wood trusses shall confirm to E18.

(m) Sheet Vapour Barrier

(i) Sheet vapour barrier shall confirm to E19.

(n) Air barrier

(i) Air barrier shall confirm to E20.

(o) Board Insulation

(i) Board insulation shall confirm to E21.

(p) Batt and Blanket Insulation

(i) Batt and blanket insulation shall confirm to E22.

(q) Aluminum Soffit

(i) Aluminum soffit shall confirm to E 23.

(r) Metal Roofing System

(i) Metal roofing system shall confirm to E24.

(s) Joint Sealers

(i) Joint sealers shall confirm to E25.

(t) Steel Hollow Metal Doors and Frames

(i) Steel hollow metal doors and frames shall confirm to E26.

(u) Portland Cement Parging

(i) Portland cement parging shall confirm to E27.

(v) Painting

(i) Painting shall confirm to E28.

(w) Graffiti Resistant Coating

(i) Graffiti resistant coating shall confirm to E29.

(x) Swing Arm, Chain Hoist and Push Trolley

(i) Swing arm, chain hoist and push trolley shall confirm to E30.

(y) Pultruded Fibreglass Structural Shapes and Square Tube Handrail

(i) Pultruded fibreglass structural shapes and square tube handrail shall confirm to E31.

(z) Electrical

(i) Electrical works shall conform to E34.

(aa) Mechanical

(i) Mechanical works shall conform to E35,E36 and E37.

(bb) Ventilation

(i) Ventilation works shall conform to E32

E11.3 Construction Methods

(a) Excavation

(i) Remove excavated material from the site immediately. Excavated material shall not be stockpiled on-site unless it will be used as backfill the same day it is excavated.

(ii) Place a minimum 75 millimetre thick lean mix concrete slab in the bottom of the excavation to provide a clean working base upon completion of the excavation to the required limits. Allow the concrete to set for twenty-four (24) hours before setting up forms or placing reinforcing steel.

(iii) Lean mix concrete shall be well-tamped and screened to give a level working platform for setting up forms and placing reinforcing steel.

(iv) Supply and place lean mix concrete, as directed by the Contract Administrator, as backfill for any portion of the excavation, carried beyond the required limits of excavation. The limits of excavation shall be considered to be the inside face of the shoring system and the underside of the working base slab.

(v) All working areas below grade shall be kept adequately and securely supported during and after excavation until the shoring and bracing is in place to prevent loss of ground or injury to any person from falling material.

(b) Excavation Security Fence

(i) Further to Clause 3.1 of CW 1130, completely cover the excavation and provide a security fence to completely surround the excavation when unattended generally in accordance with the following.

(ii) Security fence shall be chain link fence or approved equal in accordance with B6, a minimum 1.80 metres high with metal support posts embedded far enough into the ground and spaced close enough together so the fence will not sag or collapse.

(iii) Attach fencing securely to posts.

(iv) Secure the gate or end of the fencing to a post with chain and a padlock.

(v) Provide alternate security fence proposal to Contract Administrator for approval.

(c) Shoring

(i) The type, strength, and amount of shoring and bracing shall be such as the nature of the ground and attendance conditions may require, taking into account property lines, existing slopes, utilities and roadways.

(ii) Shoring and bracing shall be so spaced and dimensioned as to prevent caving, loss of ground, surface settlement, or squeezing of the soil beyond the neat lines of excavation. It shall be free from defects that might impair its strength or suitability for the work. Sheeting/shoring and bracing shall conform to the latest revisions of the “Construction Safety Act” of the Department of Labour of the Government of Manitoba.

(iii) Shoring will be designed by a qualified Professional Engineer. registered to practice in the Providence of Manitoba. Supporting design calculations and drawings as required to facilitate review of the submission for conformance with the Contract Documents. The designer of the shoring system shall inspect the system during construction and certify, in writing to the Contract Administrator, that construction is in conformance with the approved design. The designer shall also inspect the shoring system on a weekly basis and submit a written report of his findings to the Contract Administrator after every inspection.

(iv) Shoring and bracing shall be installed such that the structure size, wall thickness, and any work relating to the construction of the pumping station as shown on the drawings can be achieved subsequent to installation of the shoring system.

(v) Shoring and bracing shall remain in place until concrete has attained 75% of the design strength as determined by concrete sample testing. Do not remove shoring and bracing without approval of the Contract Administrator.

(d) Backfill

(i) Place and compact backfill material as indicated on the Drawings in accordance with CW 2030. Do not place backfill material in a frozen state. Supply heating and hoarding in accordance with CW 2160 if required to ensure material does not freeze before compaction is complete.

(ii) Notify the Contract Administrator at least one (1) full working day in advance of any backfilling operation. No Backfill shall be placed against concrete until approved by the Contract Administrator and in no case before field cured test cylinders show the concrete strength to be 75% of that specified.

(e) Grout

(i) Mix and apply grout in accordance with the manufacturer's instructions. Consistency to be suitable for the intended application.

E11.4 Measurement and Payment

(a) Wastewater Pumping Station will be measured on a Unit basis and paid for at the Contract Unit Price for "Wastewater Pumping Station", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E12. CAST-IN-PLACE CONCRETE

E12.1 Description

(a) This Specification shall cover the construction of cast-in-place concrete for the wastewater pumping station, which the Contractor shall carry out in accordance with Specification CW 2160 and CSA A23.1, except as amended or supplemented herein.

E12.2 Materials

(a) Concrete Mix Design

(i) Concrete mix design shall be as indicated in the Construction Notes on the Drawings.

(b) Lean-Mix Concrete Design

Lean mix concrete design shall be in accordance with performance specification and shall have the following properties:

(i) Cement: Type 50

(ii) Minimum Compressive Strength @ 28 days: 15 MPa

(iii) Slump: 80 mm

(iv) Air Content: nil

(v) Maximum Water/Cement Ratio = 0.49

(c) Grout

(i) Grout shall be Sika Grout 212 or approved equal in accordance with B6.

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(d) Bonding Agent

(i) Bonding agent shall be ACRYL-STIX or approved equal in accordance with B6.

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(e) Waterstop

(i) Waterstop shall be 150 wide by 3/8 thick vinylex ribbed-center bulb or approved equal in accordance with B6.

E12.3 Construction Methods

E12.3.1 Construction Method Submission

(a) No work shall commence on construction of wastewater pumping station until after the Contract Administrator's review of the Contractor's Construction Method submission.

(b) Excavation for the construction of the wastewater pumping station shall be by the tight shored excavation method.

(c) The Contractor shall prepare for the Contract Administrator's review a Construction Method submission detailing:

(d) Construction sequence to be followed including all methods to be employed to ensure no damage occurs to existing structures or adjacent properties within or adjacent to an excavation.

(e) Shoring system to be used.

(f) Proposed method of pumping station construction.

(g) Specialized equipment to be used.

(h) Any design revisions proposed to accommodate the Contractor's proposed construction method.

(i) Water control considerations including details on the Contractor's proposed method of groundwater and surface runoff control.

(j) The Contractor shall respond to any concerns that may be raised by the Contract Administrator after review of Construction Method submission.

E12.3.2 Cast in place Concrete Construction

(a) Adjust the location of reinforcing steel adjacent to openings and in location of the waterstop along the center wall to frame those openings and insert the link seal in accordance with good practice, and maintain the bar spacing intent.

(b) Do not use welded splices for reinforcing steel.

(c) Order all wall reinforcing steel in lengths to best suit the spacing of walers so that reinforcing bars will not be bent or misformed in order to remove the walers.

(d) Install foundation waterproofing in accordance with E14 of this Specification.

E12.4 Measurement and Payment

(a) Supply and placement of cast-in-place concrete shall be included with wastewater pumping station and paid for under the Contract Unit Price for "Wastewater Pumping Station", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E13. REINFORCING STEEL

E13.1 Description

(a) This Specification shall cover all reinforcing steel work, in accordance with Specification CW 2160, except as amended or supplemented herein.

E13.2 Materials

E13.2.1 Reinforcing Steel

(a) Further to CW 2160 Sentence 2.6 Materials: Reinforcing Steel, all reinforcing steel shall conform to the requirements of CSA G30.18, Grade 400.

E13.2.2 Bar Accessories

(a) Bar accessories shall be of type approved by the Contract Administrator. They shall be made from a non-corroding material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete. Bar chairs are to be PVC; galvanized bar chairs are not acceptable.

(b) Bar accessories shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices that may be approved by the Contract Administrator. Bar accessories are not shown on the Contract Drawings. The supply and installation of bar accessories shall be considered incidental to the supply and placing of reinforcing steel.

E13.3 Construction Methods

E13.3.1 Placing of Reinforcing Steel

(a) Reinforcing steel shall be placed accurately in the positions shown on the Contract Drawings. Carefully adjust the location of reinforcing steel adjacent to openings to frame those openings in accordance with good practice, and maintain the bar spacing intent.

(b) Splices in reinforcing steel shall be made only where indicated on the Contract Drawings. Prior approval of the Contract Administrator shall be obtained where, in the opinion of the Contractor, other splices must be made. All splices shall have laps of at least 40 bar diameters. Welded splices shall not be used.

(c) A minimum of twenty-four (24) hours notice shall be given to the Contract Administrator prior to the pouring of any concrete to allow for inspection of reinforcing steel.

E13.3.2 Quality Control

(a) The Contractor shall provide, without charge, the samples of reinforcing steel required for quality control tests and provide such assistance and use of tools and construction equipment as is required.

E13.3.3 Shop Drawings

(a) The Contractor shall submit shop drawings in accordance with E18 for the Contract Administrator's approval two (2) weeks prior to the fabrication of any reinforcing steel.\

E13.4 Measurement and Payment

(a) Supply and placement of reinforcing steel shall be included with wastewater pumping station and paid for under the Contract Unit Price for "Wastewater Pumping Station", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E14. FOUNDATION WATERPROOFING

E14.1 Description

(a) This Specification shall cover the supply and placement of all foundation waterproofing work.

E14.2 Materials

(a) Waterproofing membrane: Styrene-Butadiene-Styrene (SBS) elastomeric polymer, prefabricated sheet, reinforced with non-woven polyester weighing 180 g/m². Top surface polyethylene film. Bottom surface: thermofusible plastic film. Acceptable material: Soprema Sopralene Flam 180, IKO Aquabarrier TG.

(b) Primes, mastic sealant, and accessories: as recommended by membrane manufacturer, applicable for substrate.

(c) Protection board: insulating fibreboard to CAN/CSA-A247, Type II, 12 mm thick.

E14.3 Construction Methods

E14.3.1 Quality Assurance

(a) Work of this section shall be performed by workers approved and trained by manufacturer for application of its products. Applicators must have minimum 5 years

proven experience. If requested, submit proof of experience, in writing, from manufacturer.

E14.3.2 Environmental Requirements

(a) Maintain air temperature and structural base temperature at installation area above membrane manufacturer's recommendations before, during and 72 hours after installation.

(b) For applications in freezing weather do not commence application until authorized by membrane manufacturer.

(c) For enclosed applications ensure adequate forced air circulation during curing period.

(d) Install membrane on dry substrates, free of snow and ice. Use only dry materials and apply only during weather that will not introduce moisture beneath waterproofing membrane.

E14.3.3 Warranty

(a) Provide written warranty, signed and issued in the name of The City stating that the waterproofing is guaranteed against leaking, loss of adhesion, for a period of five (5) years from the date of completion

E14.3.4 Preparation

(a) Examine substrates and site conditions to ensure acceptability for application of waterproofing membranes. Notify Contract Administrator, in writing, of unsuitable surfaces or working conditions.

(b) Do not commence application until all other work that will penetrate membrane is complete.

(c) Clean substrates of all snow, ice, loose particles, oil, grease, dirt, curing compounds, or other foreign matter detrimental to application of primers and waterproofing membranes.

(d) Ensure concrete surfaces are fully cured and dry using test methods recommended by membrane manufacture.

(e) Repair defects in concrete surfaces such as spalled or poorly consolidated concrete. Remove sharp protrusions, sharp edges and form lines.

(f) Patch rough areas with a weld-adhered parge coat to provide smooth surface. Allow to fully cure and dry.

E14.3.5 Priming

(a) Apply primer in accordance with manufacturer's instructions at recommended rate of application.

(b) Do not apply to frozen or damp surfaces. Apply only when air and surface temperatures are within manufacturer's recommended limits.

(c) Avoid pooling of primer and allow to cure until tack-free.

(d) Prime only the area to be covered with membrane in a working day. Re-prime areas not covered with waterproofing within 24 hours of application of primer.

E14.3.6 Membrane Application

(a) Apply membrane in accordance with manufacturer's instructions and with good construction practice to maintain continuity of waterproofing over building elements.

(b) Place membrane in position without stretching, taking care to avoid trapped air, creases, or fish mouths.

(c) Ensure membrane is totally bonded to substrate.

(d) Apply membrane vertically in longest possible lengths to reduce number of end joints.

(e) Overlap side laps minimum 75 mm and end laps minimum 150 mm. Stagger end laps minimum 300 mm in adjacent rows.

(f) Seal horizontal and vertical terminations by applying heavy pressure to edges with a roller to ensure positive bond. Apply a continuous bead of mastic sealant to all terminations. Make watertight. Seal daily terminations with mastic sealant.

(g) Corners:

(h) Remove sharp or protruding edges from external corners prior to application of membrane.

(i) Reinforce external corners with cushion strip of membrane minimum 300 mm wide at each corner. Install cushion strip below main membrane.

(j) Protrusions and Penetrations:

(k) Apply two layers of membrane flashing around protrusions and extend at least 150 mm in all directions. Cut and fit membrane neatly and snug fitting, leave no gaps. Seal all terminations with mastic sealant. Flash protrusions with liquid mastic extending 150 mm along pipe or conduit.

(l) Seal with liquid mastic all protrusions or difficult detail areas which do not allow easy installation of membrane. Make watertight.

E14.3.7 Inspection and Repair

(a) Inspect membrane thoroughly before covering and make corrections immediately.

(b) Patch and repair misaligned or inadequately lapped seams, tears, punctures, or fishmouths.

(c) Patch with piece of waterproofing membrane and extend minimum 150 mm in all directions from fault and seal edges with mastic sealant.

(d) Protection Board

(e) Install protection board against all waterproofing membranes to protect against backfilling operations.

(f) Install boards vertically without fasteners or adhesives.

(g) Install protection board during backfilling operations to allow backfill materials to hold protection board tight to waterproofing membrane.

E14.4 Measurement and Payment

(a) Supply and placement of Foundation Waterproofing shall be included with wastewater pumping station and paid for under the Contract Unit Price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E15. METAL FABRICATIONS

E15.1 Description

(a) This Specification shall cover the supply fabrication and placement of all metal fabrications.

E15.2 Materials

E15.2.1 General

(a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification.

(b) All materials supplied under this Specification shall be of a type acceptable to the Contract Administrator, and shall be subject to inspection and testing by the Contractor Administrator.

(c) All materials shall be handled in a careful and workmanship like manner, to the satisfaction of the Contract Administrator.

(d) Supply, safely store and handle materials set forth in this Specification. Handle materials in a careful and workmanship like manner, to the satisfaction of the Contract Administrator.

E15.2.2 Steel Sections and Plates: to CAN/CSA G40.20/G40.21, Grade 300 W, except W, HP and HSS sections, which shall be Grade 350 W.

E15.2.3 Steel pipe: to ASTM A 53/A53M, seamless, galvanized, as specified by item.

E15.2.4 Welding materials: to CSA W59.

E15.2.5 Stud Anchors: to ASTM A108, Grade 1020.

E15.2.6 Aluminum: to CAN/CSA S157 and the Aluminum Association 'Specifications for Aluminum Structures'. Aluminum for plates shall be Type 6061-T651. Welding shall be in accordance with the requirements of CSA W59.2-M1991.

E15.2.7 Fasteners:

(a) Anchor bolts and fasteners: Type 316 stainless steel, of ample section to safely withstand the forces created by operation of the equipment or the load to which they will be subjected.

(b) Quantity and size of the fasteners shall be as recommended by the manufacturer or as shown on the Drawings.

(c) Provide exposed fastenings of same material, and finish as the metal to which applied unless indicated otherwise.

(d) Supply all items complete with all anchors and fastenings.

E15.2.8 Wet Well Ladder Safety Post

(a) Bilco LadderUP Model LU-2, galvanized, secured using A316 stainless steel bolts.

E15.3 Construction Methods

E15.3.1 Submittals

(a) Submit the qualifications of the Contractor, qualifications of operators, shop drawings, mill certificates and welding procedures to the Contractor Administrator for acceptance in accordance with E6 Shop Drawings.

(b) Submit clearly indicating materials, core thickness, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories. Indicate field measurements on Shop Drawings.

E15.3.2 Fabrication

(a) Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

(b) Use self-tapping shake-proof flat headed screws on items requiring assembly by screws.

(c) Where possible, fit work and shop assemble, ready for erection.

(d) Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

(e) Seal exterior steel fabrications to provide corrosion protection in accordance with CAN3-S16.1.

(f) Remove and grind smooth burrs, filings, sharp protrusions, and projections from metal fabrications to prevent possible injury. Correct any dangerous or potentially harmful installations as directed by Contract Administrator.

(g) All aluminum surfaces in contact with concrete shall be isolated using alkali-resistant bituminous paint meeting the requirements of CGSB 31-GP-3M.

(h) Aluminum plate shall have an approved raised oval or multi-grip pattern with edges straight and true, and shall be cut as far as practical to maintain continuity of the pattern at abutting edges.

(i) Pieces shall be of the sizes indicated on the Drawings and shall not be built up from scrap pieces.

(j) Angle frames shall be of the same material as the cover plate, and cover plates shall be hinged and be supplied with lifting handles, as shown on the Drawings. Exterior covers shall be supplied with a hasp for a padlock.

E15.3.3 Finishes

(a) All designated steel items supplied under this specification shall be hot-dip galvanizing after fabrication, in accordance with CAN/CSA-G164, to a retention of 600 gm/m^2.

E15.3.4 Angle Lintels

(a) Steel angles: sizes indicated for openings. Provide minimum 150 mm bearing at ends. Hot dip galvanized.

E15.3.5 Pipe Bollards

(a) Steel pipe: double strong, diameter indicated, hot-dip galvanized.

(b) Concrete: Type 50 sulphate resistant, 20 MPa.

(c) Fabricate and install pipe bollards to be removable as indicated on the Drawings. Set pipe sleeve level and plumb into reinforced concrete footing. Fabricate bollard of steel pipe to fit over top of pipe sleeve and secure to pipe sleeve with 12 mm diameter hot dipped galvanized thru-bolt with nut and washers. Cap top of pipe with 6 mm thick welded steel plate.

E15.3.6 Erection

(a) Do welding work in accordance with CSA W59.

(b) Erect metalwork in accordance with reviewed shop drawings, square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

(c) Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

(d) Provide components for building in accordance with shop drawings and schedule.

(e) Make field connections with bolts to CAN/CSA-S16.1, or weld.

(f) Touch-up rivets, bolts and burnt or scratched surfaces that are to receive paint finish, with zinc primer after completion of erection.

(g) Touch-up damaged galvanized surfaces and field welds with self-fluxing, low temperature, zinc-based alloy rods in accordance with ASTM A780 Repair of Damaged Hot Dip Galvanizing Coatings. Accepted products are Galvalloy and Gal-Viz.

(h) Aluminum angle frames shall be anchored into the concrete as shown on the Drawings. Care shall be taken in placing the frames to the exact level, dimension and location required.

(i) Cover plates shall be hinged and shall be supplied with lifting handles, as shown on the Contract Drawings. Exterior covers shall be supplied with a hasp for a padlock.

E15.4 Measurement and Payment

(a) Metal fabrication shall be included with wastewater pumping station and paid for under the Contract Unit Price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E16. MASONRY

E16.1 Description

(a) This Specification shall cover the supply and placement of all masonry work.

E16.2 Materials

(a) Concrete masonry units: to CSA A165 Series (CSA A165.1). Classification H/15/A/M. Provide purpose made shapes for lintels and bond beams.

(b) Face Brick: burned clay brick: to CSA A82.1, Type: FBS, Grade: SW, Metric modular size. Provide solid units where core exposed in final assembly. Acceptable material: IXL 246 Whistler Gray Rockfaced. Running bond.

(c) Limestone: to ASTM C 568, category II, medium density as quarried and supplied by Gillis Quarries Limited, Winnipeg, Manitoba, Canada. Buff colour, rustic finish, 90 mm bed thickness. Sawn-bed, three coursed random ashlar pattern, 15% 57 mm course, 50% 123 mm course, 35% 190 mm course height.

(d) Mortar Materials: to CSA A179. Type N based on Proportion specifications. Use non-staining mortar for limestone work.

(e) Masonry connectors: to CSA A370 and CSA S304, galvanized. Block Shear Connector assembly as manufactured by Fero Holdings Ltd. Consisting of connector plate, V-Tie and polyethylene insulation support.

(f) Masonry reinforcement:

(i) Bar reinforcement: to CSA A371 and CSA G30.18, Grade 400.

(ii) Wire reinforcement: to CSA A371 and CSA G30.14, ladder type. Prefabricated corners and intersections.

(g) Masonry flashing: self-adhesive modified bitumen sheet membrane: minimum 1.0 mm thick. Bakelite Blueskin SA, WR Grace Perm-A-Barrier, Soprema Colphene 1500.

(h) Metal drip edge: brake formed of 24 gauge prefinished steel sheet of same colour as sheet metal roofing, Form drip edge to extend 100 mm under base course, with 6 - 9 mm formed drip at front edge.

E16.3 Construction Methods

(a) Do masonry work in accordance with CSA-A371 except where specified otherwise.

(b) Before commencing masonry work construct mock-up panel for Contract Administrator's review and approval. Construct mock-up panel approximately 1200 x 1200 mm size, on exterior wall of building in location designated by Contract Administrator. Materials and workmanship as specified for finished work. Mock-up panel, if accepted, may become part of the finished work. If not accepted, demolish and construct new panel if requested.

(c) Lay concrete masonry units in running stretcher bond. Coursing height 200 mm of one block and one joint

(d) Lay clay brick in running stretcher bond, coursing height 200 mm for three bricks and three joints. Provide soldier coursing as indicated, using solid units at corners. Exposed cores not permitted.

(e) Lay limestone in random ashlar pattern bond. Joint lines to run horizontally and vertically. Stagger vertical joints and break horizontal joints as often as possible. Balance distribution of stone sizes for best appearance.

(f) Supply and install masonry connectors and reinforcement in accordance with CSA A370, CSA A371, CSA A23.1 and CSA S304.1, and as indicated. Coordinate the installation of the truss uplift anchors with truss subcontractor.

(g) Build masonry plumb, level, and true to line, with vertical joints in alignment. Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

(h) Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

(i) Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.

(j) Build in items required to be built into masonry. Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

(k) Construct continuous control joints in exterior masonry veneer. Fill joints with joint filler, backer rods and sealant.

(l) Tool joints with round jointer to provide concave joints where exposed or to receive paint or other thin finish coating. Strike flush joints in concealed spaces.

(m) Keep masonry cavities free of mortar droppings.

(n) Provide weep holes over masonry flashings, spaced at maximum 800 mm on centre.

(o) Build in flashings in masonry in accordance with CAN3-A371. Carry under base course and up backup wall minimum 150 mm and seal stop edge.

(p) Install metal drip edge over masonry flashings at base courses and angle lintels. Align drip edge straight and even. Overlap joints minimum 20 mm.

E16.3.1 Cleaning

(a) Clean stone as work progresses. Allow mortar droppings on stone to partially dry then remove by means of brushing with a stiff fibre brush.

(b) Post construction: clean area of wall designated by Contract Administrator as directed below and leave for one week. If no harmful effects appear and after mortar has set and cured clean masonry as follows:

(i) Protect sills, doors, trim and other work

(ii) Remove large particles with wood paddles without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.

(iii) Scrub with solution of 25 mL trisodium phosphate and 25 mL household detergent dissolved in 1 L of clean water using stiff fibre brushes, then clean off immediately with clean water using hose. Alternatively, use proprietary compound recommended by brick masonry manufacturer in accordance with manufacturer's directions.

(iv) Repeat cleaning process as often as necessary to remove mortar and other stains.

(v) Use alternative cleaning solutions and methods for difficult to clean stone only after consultation with masonry unit manufacturer.

E16.4 Measurement and Payment

(a) Masonry work shall be included with wastewater pumping station and paid for under the Contract Unit Price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E17. CARPENTRY

E17.1 Description

(a) This Specification shall cover the supply, fabrication, transportation, handling, delivery and placement of all carpentry work.

E17.2 Materials

E17.2.1 Lumber materials:

(a) Except as indicated or specified otherwise lumber shall be softwood, S4S, moisture content not greater than 19% at time of installation, in accordance with CAN/CSA 0141 and NLGA Standard Grading Rules for Canadian Lumber.
(b) Glued end-jointed (finger-jointed) lumber is not acceptable.
(c) Framing and board lumber: SPF species, NLGA No.2 grade or better.

(i) Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

E17.2.2 Panel Material:

(a) Type, grade and thickness indicated in accordance with the following standards. Except as specified otherwise panels shall be minimum 1200 x 2400mm (4’ x 8’) size, square edge.
(b) Douglas Fir Plywood (DFP): to CSA 0121, standard construction.
(c) Canadian Softwood Plywood (CSP): to CSA 0151, standard construction.
(d) Roof sheathing: plywood, DFP or CSP sheathing grade, T&G edge.
(e) Interior wall and ceiling panelling: plywood, DFP or CSP, G1S grade, square edge.

(i) Identify plywood by grade mark in accordance with applicable CSA standards.

E17.2.3 Accessories

(a) Nails, spikes and staples: to CSA B111 and NBC requirements. Galvanized.
(b) Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded aluminum of 6063-T6 alloy.
(c) Surface-applied wood preservative: copper napthenate or pentachlorophenol base water repellent preservative.

E17.3 Construction Methods

E17.3.1 General

(a) Comply with requirements of NBC, Part 9 supplemented by following paragraphs.

(b) Install members true to line, levels and elevations. Space uniformly.

(c) Construct continuous members from pieces of longest practical length.

(d) Install spanning members with "crown-edge" up.

E17.3.2 Erection

(a) Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

(b) Countersink bolts where necessary to provide clearance for other work.

(c) Install roof sheathing in accordance with requirements of NBC.

(d) Install furring and blocking as required to space-out and support surface applied fixtures and equipment, wall and ceiling finishes, facings, fascia, soffit, and other work indicated.

(e) Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work. Except where indicated otherwise, use material at least 38 mm thick.

(f) Install fascia backing, nailers, and other wood supports as required and secure using galvanized fasteners.

E17.3.3 Wood Preservative

(a) Treat surfaces of rough bucks, nailers, linings to rough openings, fascia backing and other lumber on exterior wall of building material. Treat material with wood preservative, before installation. Wherever possible treat materials after cutting and fitting.

(b) Apply preservative by dipping, brush or soaking to completely saturate and maintain wet film on surface for minimum three minute soak on lumber and one minute soak on plywood.

(c) Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

E17.4 Measurement and Payment

(a) Carpentry work shall be included with wastewater pumping station and paid for under the Contract Unit Price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E18. PREFABRICATED WOOD TRUSSES

E18.1 Description

(a) This Specification shall cover the supply, fabrication and placement of all prefabricated wood truss work.

E18.2 Materials

E18.2.1 Design Criteria

(a) Design trusses, bracing and bridging in accordance with CAN3-086 for building locality as ascertained by NBC Supplement No. 1, Climatic Information for Building Design in Canada and minimum uniform and minimum concentrated loadings stipulated in NBC commentary.

(b) All roof trusses are to be prefabricated and designed in accordance with the latest edition of CSA-086. Shop drawings, including connection details, bearing the stamp of a registered professional engineer in the Province of Manitoba, shall be submitted to the Contract Administrator for approval before commencement of fabrication. Timber for roof trusses and rafters shall be structurally graded in accordance with NLGA standard grading rules for Canadian Lumber (latest edition). Material may be No. 2 spruce or equal. Material shall be straight grained and kiln dried.

(c) Truss manufacturer to design, fabricate and supply complete roof framing system, including lateral bracing, and uplift anchors.

(d) Limit live load deflections to 1/240th of span.

E18.2.2 Lumber

(a) Lumber: spruce species, fire retardant treated grade, S4S, with maximum moisture content of 19% at time of fabrication and to following standards:

(i) CAN/CSA-0141
(ii) NLGA, Standard Grading Rules for Canadian Lumber.

(b) Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.

E18.3 Construction Methods

E18.3.1 Fabrication

(a) Verify connectors and other truss connectors shown on drawings.

(b) Fabricate wood trusses in accordance with reviewed shop drawings.

(c) Cut truss members to accurate length, angle, and size to assure tight joints for finished trusses.

(d) Assemble truss members to design configuration.

(e) Provide for design camber when positioning truss members.

(f) Connect members using bolts and nuts, metal gussets.

(g) Design and supply suitable metal hangers for all truss to truss connections.

(h) Provide all tie-down connectors and other truss connectors shown on drawings.

E18.3.2 Inspection

(a) Verify end bearing lengths comply with Drawings and code requirements.

(b) Commencement of installation means acceptance of existing conditions.

(c) Truss supplier shall include in the contract price to provide site inspections and certification that trusses were constructed and erected in accordance with Drawings and code requirements.

E18.3.3 Erection

(a) Erect wood trusses in accordance with reviewed erection drawings.

(b) Indicated lifting points to be used to hoist trusses into position.

(c) Exercise care to prevent out-of-place bending of trusses.

(d) Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed.

(e) Install permanent bracing in accordance with structural drawings and reviewed shop drawings, prior to application of loads to trusses.

(f) Restrict construction loads to design loads to prevent overstressing of truss.

(g) Do not cut or remove any truss material without approval of Contract Administrator.

E18.3.4 Shop Drawings

(a) Submit shop drawings in accordance with E8 Shop Drawings.

(b) Each shop, layout and erection drawing submission shall bear signature and stamp of professional engineer registered or licensed in Province of Manitoba.

(c) Provide truss layout identifying truss mark numbers, location, quantity of each, etc.

(d) Indicate species, sizes and stress grades of lumber used as truss members. Show pitch, span, camber, configuration and spacing of trusses. Indicate connector types, thickness, sizes, locations and design value. Show bearing details. Indicate design load for each member.

(e) Submit stress diagram or print-out of computer design indicating design for each truss member. Indicate allowable load and stress increase.

(f) Indicate arrangement of webs or other members to accommodate ducts and other specialties.

(g) Show lifting points for storage, handling and erection.

(h) Show location of lateral bracing for compression members.

E18.3.5 Delivery and Storage

(a) Store trusses on job site in accordance with manufacturer's instructions. Provide bearing supports and bracings. Prevent bending, wrapping and overturning trusses.

(b) Trusses shall be wrapped with plastic until erected.

E18.4 Measurement and Payment

(a) Supplying and placing of fabricated wood trusses shall be included with wastewater pumping station and paid for under the Contract Unit Price for "Wastewater Pumping Station", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E19. SHEET VAPOUR BARRIER

E19.1 Description

(a) This Specification shall cover the supply, fabrication, transportation, handling, delivery and placement of sheet vapour barrier work.

E19.2 Materials

(a) Sheet Vapour Barrier: polyethylene film to CAN/CGSB-51.33, Type 1, 0.15 mm thick.

(b) Joint sealing tape: air pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50mm wide for lap joints and perimeter seals, 25mm wide elsewhere.

(c) Sealants: acoustical sealant.

(d) Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

E19.3 Construction Methods

E19.3.1 General

(a) Install sheet vapour barrier on warm side of exterior wall, ceiling and floor assemblies as indicated, to form continuous barrier.

(b) Use sheets of largest practical size to minimize joints.

(c) Inspect sheets for continuity. Repair punctures and tears with sealing tape before work is concealed.

E19.3.2 Exterior Surface Openings

(a) Cut sheet vapour barrier to form openings and ensure material is lapped and sealed to frame.

E19.3.3 Perimeter Seals

(a) Seal perimeter of sheet vapour barrier as follows:

(i)Apply continuous bead of sealant to substrate at perimeter of sheets.
(ii) Lap sheet over sealant and press into sealant bead.
(iii) Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

E19.3.4 Lap Joint Seals

(a) Seal lap joints of sheet vapour barrier as follows:

(i) Attach first sheet to substrate.
(ii) Apply continuous bead of sealant over solid backing at joint.
(iii) Lap adjoining sheet minimum 150mm and press into sealant bead.
(iv) Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

E19.3.5 Electrical Boxes

(a) Seal electrical switch and outlet device boxes tat penetrate vapour barrier as follows:

(i) Install moulded box vapour barrier or wrap boxes with polyethylene film sheet providing minimum 300mm perimeter lap flange.
(ii) Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

E19.4 Measurement and Payment

(a) The supplying and installation of sheet vapour barrier shall be included with wastewater pumping station and paid for under the Contract Unit Price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E20. AIR BARRIER

E20.1 Description

(a) This Specification shall cover the supply, fabrication, transportation, handling, delivery and placement of all air barrier work.

E20.2 Materials

(a) Air barrier membrane: SBS modified bitumen sheet membrane fibreglass reinforced, top and bottom surface thermofusible plastic film, minimum 2.5 mm thick. Acceptable material: Soprema Sopraseal 60 F/F, Bakor Blueskin TG, IKO Aquabarrier TG.

(b) Primers, mastics and sealants: of type recommended by manufacturer, suitable for substrate and application.

(c) Flashing and stripping membranes: as recommended by air barrier membrane manufacturer.

E20.3 Construction Methods

E20.3.1 Environmental Conditions

(a) Apply primers and membranes in dry weather and only when air and surface temperature are within manufacturer's recommended limits.

(b) For applications below recommended temperature consult manufacturer and do not proceed until approved by manufacturer or his representative.

E20.3.2 Preparation

(a) Clean substrates of snow, ice, loose particles, oil, grease, dirt, curing compounds, or other foreign matter detrimental to installation and bonding of air barrier membrane. Repair defects in masonry surfaces. Remove sharp protrusions and rough edges.

E20.3.3 Installation

(a) Prime substrates in accordance with manufacturer's instructions. Apply primers at recommended rate of application.

(b) Install materials in accordance with manufacturer's instructions using only materials approved for use with their products. Apply with good construction practice to maintain continuity of air barrier membrane over building elements.

(c) Overlap side and end laps minimum 50 mm. Stagger end laps minimum 300 mm in adjacent rows. Locate end joints minimum 300 mm from internal and external corners.

(d) Install sheets horizontally between masonry ties penetrating membrane. Overlap horizontal joints minimum 50 mm. Slit membrane at each tie and seal making airtight.

(e) Place membrane in position without stretching, taking care to avoid trapped air, creases or fishmouths. Ensure full contact and bond to substrates.

(f) Flash and seal around all penetrations and protrusions such as pipes, conduits, steel angle supports, masonry ties, anchors. Cut and fit membrane neatly and snug fitting, leave no gaps. Make airtight.

(g) Seal with mastic all difficult detail areas that do not allow easy installation of membrane. Make airtight.

(h) At rough openings cut air barrier membrane to form opening. Return membrane into opening and seal to rough bucks. Reinforce corners with additional piece of membrane cut and formed to seal corners.

(i) Overlap and seal air barrier membrane to vapour barriers and waterproofing membranes installed by other trades. Maintain continuity of building air/vapour barrier system over entire building.

(j) Inspect membrane for defects and poor workmanship before covering and make corrections immediately.

(k) Patch and repair misaligned or inadequately lapped seams, tears, punctures or fishmouths to the satisfaction of the Contract Administrator.

(l) Patch cuts, tears, and punctures by bonding an additional layer of air barrier membrane over damaged area. Patch shall extending minimum 150 mm in all directions from fault. Seal and make airtight.

E20.4 Measurement and Payment

(a) The supplying and installation of air barrier membrane shall be paid for under the unit price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all

materials and for performing all operations herein described and all other items incidental to the work included in this Specification

E21. BOARD INSULATION

E21.1 Description

(a) This Specification shall cover the supply and placement of all board insulation work.

E21.2 Materials

(a) Board insulation: expanded polystyrene board to CAN/ULC-S701, Type 3, thickness as indicated on Drawings, ship lapped edges. Acceptable material: Styrofoam Cavitymate.

(b) Fasteners: concrete anchors with flat discs or washers, for attachment of insulation to concrete surfaces

E21.3 Construction Methods

E21.3.1 Installation

(a) Install insulation after building substrate materials are cured and dry.

(b) Install insulation to maintain continuity of thermal protection to building elements and spaces. Fit insulation tight around electrical, plumbing and heating pipes and ducts, around exterior doors and windows and other penetrations and protrusions. Cut and trim insulation neatly to fit spaces.

(c) Install insulation boards in parallel rows. Butt joints tightly, offset vertical joints. Interlock boards at corners. Use longest pieces possible to reduce number of joints.

(d) Install insulation boards on outer surface of inner wythe of wall cavity with plastic insulation clips over masonry ties to hold insulation tight to backup wall. Install boards horizontally between masonry ties, with horizontal joints centred on ties.

(e) Install insulation over foundation waterproofing with concrete anchors complete with nailing discs or washers. Provide a minimum of five (5) anchors per 600 x 1200 mm of insulation board. Provide additional anchors spaced at 300 mm on centre around perimeter of openings, corners and abutments. Ensure concrete anchors are securely seated. Replace loose fasteners or provide additional fastener adjacent to loose fastener

E21.4 Measurement and Payment

(a) The supplying and installation of board insulation shall be paid for under the unit price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification..

E22. BATT AND BLANKET INSULATION

E22.1 Description

(a) This Specification shall cover the supply, fabrication, transportation, handling, delivery and placement of all batt and blanket insulation work.

E22.2 Materials

(a) Batt and blanket mineral fibre insulation: to CAN/ULC-S702, Type 1 – no membrane. Thickness indicated on Drawings.

E22.3 Construction Methods

(a) Install insulation to maintain continuity of thermal protection to building elements and spaces.

(b) Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

(c) Fill all voids completely. Cut and trim insulation neatly to fill voids; leave no gaps. Do not compress insulation to fit into spaces.

E22.4 Measurement and Payment

(a) The supplying and placing of batt and blanket insulation shall be paid for under the unit price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E23. ALUMINUM SOFFIT

E23.1 Description

(a) This Specification shall cover the supply, fabrication and placement of all aluminum soffit work.

E23.2 Materials

(a) Soffit: to CAN/CGSB-93.2, Type B, Class 1, colour to match Vicwest Blue heron VW-6079, medium gloss, plain pattern surface, flat sheet 'V' crimped for stiffness, vented 0.1 m² of opening for every 30 m² of building area preformed with elongated slits and small perforations.

(b) Exposed trim: inside corners, outside corners, starter strip and trim of same material, colour and gloss as soffit, with fastener holes pre-punched.

(c) Nails: to CSA B111, aluminum alloy, of type recommended by manufacturer.

E23.3 Construction Methods

(a) Install soffit in accordance with CAN/CGSB-93.5M, and manufacturer's written instructions

(b) Install continuous starter strips, inside and outside corners, trim, and flashings.

(c) Maintain joints true to line, tight fitting, hairline joints.

(d) Attach components in manner not restricting thermal movement.

E23.4 Measurement and Payment

(a) The supplying and placing of aluminium soffit shall be paid for under the unit price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work.

E24. METAL ROOFING SYSTEM

E24.1 Description

(a) This Specification shall cover the supply, fabrication and placement of all metal roofing system work.

E24.2 Materials

E24.2.1 Acceptable Material:

(i) Marquis 450 roof panels as manufactured by VicWest Steel.

(ii) Flynn Standing Seam complete with battens

(iii) or approved equal in accordance with B6.

E24.2.2 Components

(a) Roof panels:

(i) Fabricated from 24 gauge galvanized sheet steel to ASTM A653M, Grade 230, with Z275 zinc coating.
(ii) Finish: factory precoated with high molecular polyester coating Colorite HMP, colour VW-6079 Blue Heron.
(iii) Colour sample to be approved by Contract Administrator.

(b) Metal flashings, trim, closures exposed to view: prefinished steel sheet of same gauge and finish as roof panels.

(c) Sheet metal accessory components not exposed to ground level view: galvanized steel sheet, minimum 24 gauge.

(d) Screws anchors: as recommended by roofing supplier. Use galvanized anchors, with length and size to meet roof system design.

(e) Deck closures: gauge and profile as recommended by manufacturer.

E24.2.3 Waterproof Membrane

(a) Self-adhesive, modified bitumen sheet, minimum 1 mm (40 mils) thick, non-slip surface. Acceptable material: IKO Armour Gard Ice and Water Protector, W.R. Grace Ice and Water Shield; Domtar Eaveshield; Nordshield Water Stopper; Bakor Eave Guard; BPCO ProGard; EMCO Gripgard.

E24.2.4 Fascia, Gutters and Downspouts

(a) Form fascia and trim of prefinished steel sheet of same material, thickness, finish and colour as roof panels.

(b) Form gutters and downspouts of prefinished steel sheet of same material, thickness, finish and colour as roof panels, conforming to sizes and profiles indicated.

(c) Form gutter liner of galvanized steel sheet, minimum 26 gauge, conforming to sizes and profiles indicated on Drawings. Form in longest possible lengths to reduce number of joints. Seal joints against leakage.

(d) Provide goosenecks, outlets and necessary fastenings.

(e) For open type downspouts fabricate of prefinished steel sheet with same finish and colour on both sides of sheet. Prefinished sheet steel colour to match colour of clay brick veneer as closely as possible. Submit samples to Contract Administrator for review prior to ordering material

(f) Gutter hangers, purpose made, concealed type. Spikes and ferrules not permitted.

E24.3 Construction Methods

E24.3.1 Guarantee

(a) Provide a written guarantee, signed and issued in the name of The City stating that the entire roofing system is guaranteed against leaking for a period of two (2) years from the date of completion.

E24.3.2 Standards

(a) The materials and installation shall meet the applicable standards of the National Building Code, Underwriters Laboratories of Canada (ULC), the Canadian Standards Association (CSA) and any other applicable codes, standards and by-laws.

(b) Written confirmation of conformance with these standards shall be provided to The City.

E24.3.3 Shop Drawings

(a) Submit shop drawings in accordance with E8 to the Contract Administrator for review prior to order of materials or commencement of site work.

(b) Indicate arrangement of prefinished roof sheets, including joints, types and location of supports, fasteners, and any special shapes.

E24.3.4 Quality Assurance

(a) Roofing Contractor must be a member in good standing with the Roofing Contractors Association of Manitoba.

(b) The contractor is responsible for ensuring that the design, supply and total installation of this project are supervised and executed by fully trained and qualified personnel.

(c) Installer shall demonstrate at least five years experience in projects similar in scope.

E24.3.5 Roof System Design

(a) Prefinished roof deck supplier to design connections to substructure for maximum 2.0 kPa uplift, based on connections as required. Contractor to submit Contract Administrator sealed shop drawings of anchorage details to the Contract Administrator for review prior to fabrication and installation.

(b) Roof system fabricator is responsible for complete design and engineering of snow/ice guard system for sheet metal roofing. Guards shall be finished to match roof panels.

E24.3.6 Field Quality Control

(a) Inspection of roof application may be carried out by an independent agency selected by the Contract Administrator.

(b) Notify inspection agency minimum 48 hrs. prior to commencing roofing operations to arrange inspections. Permit agency full access to all portions of work.

(c) Note that the last inspection is to be a “final inspection”, carried out after all roofing is complete, including installation of equipment and openings, and shall be in the presence of the Contract Administrator and the Contractor.

E24.3.7 Waterproof Membrane Installation

(a) Install self-adhesive membrane in accordance with manufacturer's instructions.

(b) Roll out sheets and press firmly to substrate. As installation progresses roll with hand roller to ensure positive bond.

(c) Set first course along eaves. Overlap each succeeding course over lower. Side and end laps minimum 75 mm. Ensure full bond to roof deck and sealed at side and end laps. Avoid excessive bubbles and fish mouths.

(d) Flash and seal around openings and items penetrating roof deck. Cut and fit membrane neatly and snug fitting, leave no gaps. Seal with mastic sealant. Make water tight.

E24.3.8 Metal Roofing Installation

(a) Install metal roofing system in strict accordance with reviewed shop drawings and manufacturer's instructions.

(b) Install factory manufactured panels in longest practical lengths with special panels to suit valleys and penetrations.

(c) Provide a continuous double standard seam, mechanically locking the hold down clips into the seam.

(d) Provide notched and formed closures, to shed water, at changes in pitch and at peaks, ridges and eaves.

E24.3.9 Touch-up and Cleaning

(a) Touch up minor paint abrasions with touch-up paint provided by roof panel manufacturer to match colour of roof panels.

(b) Clean roof by dry-wiping.

(c) Leave job site completely clean.

E24.4 Measurement and Payment

(a) The supplying and placing of metal roofing system shall be paid for under the unit price for "Wastewater Pumping Station", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work.

E25. JOINT SEALERS

E25.1 Description

(a) This Specification shall cover the supply and placement of all joint sealer work.

E25.2 Materials

E25.2.1 Sealant Materials Designations

(a) Type 1 – Silicones One Part: to CAN/CGSB-19.13. Acceptable material: Dow Corning 795, GE Silpruf, Tremco Spectrum 2.

(b) Type 2 – Silicones One Part: to CAN/CGSB-19.22-M89 (Mildew resistant). Acceptable material: Dow Corning 786.

(c) Type 3 – Acrylic Latex One Part: to CGSB 19-GP-5M. Acceptable material: Tremco 100 Latex Caulk, GE Acrylasil Latex Caulk.

(d) Type 4 – Butyl: to CGSB 19-GP-14M. Acceptable material: Tremco Butyl Sealant.

E25.2.2 Accessories

(a) Preformed Compressible and Non-Compressible back-up materials.

(i) High-Density Foam. Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m density, or neoprene foam backer, size as recommended by manufacturer.

(ii) Bond Breaker Tape. Polyethylene bond breaker tape that will not bond to sealant.

(b) Joint cleanter: non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

(c) Primer: as recommended by manufacturer.

E25.3 Construction Methods

E25.3.1 Sealant Selection

(a) Perimeters of exterior openings where frames meet exterior facade of building: Sealant Type 1.

(b) Miscellaneous flashing joints and metal cladding: Sealant Type 1.

(c) Perimeter of washroom fixtures (e.g., sinks, urinals, water closets, vanities, etc.): Sealant Type 2.

(d) Interior paintable joints: Sealant Type 3.

(e) Bedding aluminum door sills: Sealant Type 4.

E25.3.2 Delivery, Storage, and Handling

E25.3.3 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

E25.3.4 Environmental and Safety Requirements

(a) Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Labour Canada.

(b) Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions

E25.3.5 Protection

(a) Protect installed work of other trades from staining or contamination.

E25.3.6 Preparation of Joint Surfaces

(a) Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

(b) Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter that may impair work.

(c) Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

(d) Ensure joint surfaces are dry and frost free.

(e) Prepare surfaces in accordance with manufacturer's directions.

E25.3.7 Priming

(a) Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

(b) Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

E25.3.8 Backup Material

(a) Apply bond breaker tape where required to manufacturer's instructions.

(b) Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

E25.3.9 Mixing

(a) Mix materials in strict accordance with sealant manufacturer's instructions.

E25.3.10 Application

(a) Sealant

(i) Apply sealant in accordance with manufacturer's written instructions.
(ii) (Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
(iii) Apply sealant in continuous beads.
(iv) Apply sealant using gun with proper size nozzle.
(v) Use sufficient pressure to fill voids and joints solid.
(vi) Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
(vii) Tool exposed surfaces before skinning begins to give slightly concave shape.
(viii) Remove excess compound promptly as work progresses and upon completion.

(b) Curing

(i) Cure sealants in accordance with sealant manufacturer's instructions.
(ii) (b) Do not cover up sealants until proper curing has taken place.

(c) Cleanup

(i) Clean adjacent surfaces immediately and leave work neat and clean.
(ii) Remove excess and droppings, using recommended cleaners as work progresses.
(iii) Remove masking tape after initial set of sealant.

E25.4 Measurement and Payment

(a) The supplying and placing of joint sealers shall be paid for under the unit price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work.

E26. STEEL HOLLOW METAL DOORS AND FRAMES

E26.1 Description

(a) This Specification shall cover the supply, fabrication and placement of all steel hollow metal doors and frames.

E26.2 Materials

E26.2.1 Fabrication Standards

(a) Fabricate doors and frames to Canadian Manufacturing Specification for Steel Doors and Frames, except where specified otherwise.

E26.2.2 Steel

(a) Commercial grade steel to ASTM A568-81, Class 1, hot-dip galvanized to ASTM A527-80, coating designation to ASTM A525-81, ZF75 (A25).

E26.2.3 Component Part Thickness

(a) Door frames: 1.6mm (16 gauge)

(b) Doors: 1.2 mm (18 gauge)

E26.2.4 Door Construction

(a) Insulated core, welded seam: For exterior use. Reinforced construction. Provide urethane foam insulated cores to R.S.I. of 1.76 (R=10). Laminated by adhesive to face sheets. Reinforced for hardware

E26.2.5 Frame Construction

(a) Mitred or mechanically jointed and continuously welded on the inside of the profile. Welded joints to be ground to a smooth uniform finish.

(b) Butt joints of mullions and transoms: accurately cope, securely weld and grind smooth.

(c) Blank, reinforce, drill and tap for mortised butts and strike. Protect cut-outs in masonry and concrete with mortar guard boxes. Reinforce for surface mounted hardware. Prepare each door for rubber bumpers, two for double door openings.

(d) Top hinge reinforcement: weld in top hinge reinforcement with 20mm leg to hinge reinforcement, 25mm to frame.

(e) Insulation: provide foam-in insulation in all exterior frame cavities.

(f) Door Hardware

(i)	Hinges	CB1960	114 x 102	NRP	630	Stanley
(ii)	Passage Set	D10S			626	Schlage
(iii)	Deadbolt	B860	626	Schlage (tamperproof “Medeco” cylinder – keyed to match City requirements)		
(iv)	Flushbolts	FB6			626	Glynn Johnson
(v)	Weatherstrip	770C				Reese
(vi)	Sweep Seals	773C				Reese
(vii)	Astragal	275C			Reese	
(viii)	Threshold	S205A			Reese	
(ix)	Door Stop/Holder	F26			626	Glynn Johnson

E26.2.6 Frame Anchors

(a) Frames for installation shall be provided with minimum four steel anchors of suitable design.

E26.2.7 Keying

(a) Keys to match The City’s existing “Medeco” system. The City to provide lock number before keying.

(b) Provide keys in triplicate for every lock.

E26.2.8 Shop Drawings

(a) Submit shop drawings in accordance with E8 Shop Drawings.

(b) Submit shop drawings clearly indicating each type of door and frame, material, steel core thickness, mortises, reinforcements, location of exposed fasteners, anchors, openings, arrangement of hardware, and finishes

E26.3 Construction Methods

E26.3.1 General

(a) Install doors and frames to CSDFMA Installation Guide.

E26.3.2 Door Installation

(a) Install doors and hardware in accordance with templates and manufacturer’s instructions.

(b) Adjust operable parts for correct function.

E26.3.3 Frame Installation

(a) Set frames plumb, square, level and at correct elevation. Secure anchorages and connections to adjacent construction.

(b) Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in. Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

E26.3.4 Painting

(a) Paint doors and frames in accordance with E28 Painting in colour approved by Contract Administrator.

E26.4 Measurement and Payment

(a) The supplying and placing of steel hollow metal doors and frames shall be paid for under the unit price for Wastewater Pumping Station, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification

E27. PORTLAND CEMENT PARGING

E27.1 Description

(a) This Specification shall cover the supply and placement of all Portland cement parging work.

E27.2 Materials

(a) Water: clean, potable and free from deleterious matter, acids or alkalis.

(b) Sand: clean, coarse, sharp, well screened conforming to CSA A82.57.

(c) Cement: normal Portland Type 10 to CAN/CSA-A5.

(d) Metal lath: diamond mesh, 1.65 kg/m^2, galvanized.

(e) Tie wire: zinc coated annealed steel wire, minimum 16 gauge diameter.

(f) Cornerite: expanded 26 gauge sheet steel, 64 mm legs, galvanized finish.

(g) Stucco stops: square, 24 gauge galvanized sheet steel or pure zinc, perforated or expanded flanges.

(h) Concrete anchors: for attachment of metal lath to concrete and masonry surfaces. Hot dipped galvanized concrete/masonry anchors. Washers 1 mm thick x 25 mm diameter steel, galvanized. Gripcon Concrete Masonry Fastening System or equal.

(i) Building paper: No.15 asphalt saturated felt to CSA A123.3.

(j) Colouring pigment: dry powder pigment for job mix in finish coat. Acceptable material Imasco Custom Colours. Colour generally matching brickwork, as selected by Contract Administrator. Provide 300 x 300 mm samples of finish coat in selected colour and texture on plywood backing for Contract Administrator’s review and approval.

E27.3 Construction Methods

E27.3.1 Mixing

(a) Detergent, soap, or other additives in mixes not permitted.

(b) Proportion parts by volume. Measurement of ingredients including water shall be accurate and successive batches shall be proportioned alike.

(c) Adjust cement and lime content by volume based on strength, workability and finishing requirements.

(d) Scratch coat: 1 part cement; 3/4 to 1½ parts lime; 2½ to 4 parts sand (volume of sand per sum of cementitious material).

(e) Parging coat: 1 part cement; 3/4 to 1½ parts lime; 3 to 5 parts sand (volume of sand per sum of cementitious material. Add colouring agent to finish coat in strict conformance with manufacturer's instructions to produce coloured stucco to match approved sample. Accurately and consistently measure ingredients to provide consistent coloured mortar for all batches.

E27.3.2 Installation Metal Lath

(a) Install sheathing paper behind metal lath. Place sheets horizontally, overlapping upper sheet over lower to shed water.

(b) Install metal lath with long dimension of sheets at right angles to supports. Offset end laps in adjacent rows.

(c) Secure at 150 mm on centre along vertical lines running 400 mm apart.

(d) Lap sheets 12 mm at sides and 25 mm at ends. Side laps shall be secured at 400 mm on centre.

(e) At external corners, wrap metal lath around corner minimum of 400 mm. Reinforce with cornerite.

(f) At internal corners, fold wire through corner minimum 400 mm. Reinforce with cornerite.

E27.3.3 Installation Accessories

(a) Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces wherever possible. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.

(b) Provide casing beads wherever parging terminates and abuts other surfaces and where specifically called for on Drawings.

E27.3.4 Cement Parging Application

(a) Scratch coat:

(i) Apply full scratch coat in sufficient thickness with sufficient pressure to form positive bond. Cross scratch and allow to set.
(ii) Damp cure for not less than 48 hours. Permit to dry.

E27.3.5 Parging coat:

(i) Apply parging coat on scratch coat no sooner than 48 hours after installation of scratch coat.

(ii) Apply over dampened scratch coat with sufficient pressure to form positive bond.

(iii) Bring out to grounds, straighten to true surface, and provide medium brush dash finish.

(iv) Damp cure for not less than 48 hours.

(a) Thickness of finish or top coats specified below are minimum thickness. Increase thickness as required to suit specified textured finishes.

(i) Scratch coat: 12 mm

(ii) Finish coat: 6 mm

(iii) Total: 18 mm

E27.4 Measurement and Payment

(a) Portland cement parging shall be paid for under the unit price for "Wastewater Pumping Station", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work.

E28. PAINTING

E28.1 Description

(a) This Specification shall cover the supply and placement of all painting work.

E28.2 Materials

E28.2.1 Paint

(a) Only paint materials listed in the MPI Approved Products List (APL) are acceptable for use on the project, except where other products are specified.

(b) Paint materials for each coating formula to be products of a single manufacturer.

(c) Colour schedule will be provided by Contract Administrator. Selection of colours will be from manufacturer's full range of colours.

E28.2.2 Paint Finishes

(a) Except for Formula 1 (epoxy) use Master Painters Institute (MPI) finishing formulae as specified below.

(b) Formula 1: for wood to receive paint finish:

(i) MPI EXT 6.4B - Alkyd GR (semi-gloss) finish premium grade.

(c) Formula 2: for shop primed and unprimed ferrous metal surfaces:

(i) MPI EXT 5.1D - Alkyd G5 (semi-gloss) finish premium grade.

(d) Formula 3: for galvanized and zinc-coated metal apply:

(i) MPI EXT 5.3B - Alkyd G5 (semi-gloss) finish premium grade.

(e) Formula 4: for concrete, walls and ceilings apply:

(i) MPI EXT 3.1A - Latex G5 (semi-gloss) finish premium grade.

(f) Formula 5: for concrete floors apply:

(i) MPI EXT 3.2D - Alkyd floor enamel #59 low gloss finish premium grade. Sprinkle with clean silica sand to provide slip-resistant surface acceptable to Contract Administrator.

E28.3 Construction Methods

E28.3.1 Standard of Acceptance

(a) Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface when viewed using final lighting source.

(b) Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

(c) Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

E28.3.2 Delivery, Storage and Handling

(a) Deliver and store materials in original containers, sealed with labels intact.

(b) Indicate on containers or wrappings:

(i) Manufacturer's name and address.
(ii) Type of paint.
(iii) Compliance with applicable standard.
(iv) Colour number in accordance with colour schedule provided by Contract Administrator.

(c) Observe manufacturer's recommendations for storage and handling.

E28.3.3 Environmental Requirements

(a) Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

(b) Ventilation: ventilate area of work by use of approved portable supply and exhaust fans.

(c) Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.

(d) Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.

(e) Apply paint only when surface to be painted is dry, properly cured, and adequately prepared.

E28.3.4 Extra Materials

(a) Submit one 4-litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.

(b) Deliver to The City and store where directed.

E28.3.5 Protection

(a) Cover or mask floors, walls, and equipment adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.

(b) Protect items that are permanently attached such as Fire Labels on doors, frames, and name plates on equipment.

(c) Protect factory finished products and equipment.

E28.3.6 Cleaning and Surface Preparation

(a) Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

(i) Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
(ii) Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
(iii) Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
(iv) Allow surfaces to drain completely and allow to dry thoroughly.

(b) Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

(c) Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

(i) Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
(ii) Apply wood filler to nail holes and cracks.

(d) Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted.

(e) Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

E28.3.7 Application

(a) Apply paint in accordance with manufacturer's application instructions unless specified otherwise.

(b) Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

(c) Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

(d) Sand and dust between each coat to remove visible defects.

(e) Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

E28.3.8 Mechanical/Electrical Equipment

(a) Do not paint exposed conduit, ductwork and hangers, unless otherwise indicated.

(b) Paint exposed piping. Colour and texture to match adjacent surfaces, except as noted otherwise.

(c) Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

(d) Do not paint over nameplates, brass or bronze surfaces or machined surfaces.

(e) Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

E28.3.9 Restoration

(a) Clean and reinstall all hardware items that were removed before undertaken painting operations.

(b) Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

E28.4 Measurement and Payment

(a) Painting shall be paid for under the unit price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work.

E29. GRAFFITI RESISTANT COATING

E29.1 Description

(a) This Specification shall cover the supply, fabrication, transportation, handling, delivery and placement of all graffiti resistant coating to all exterior masonry veneer.

E29.2 Materials

(a) Graffiti-resistant coating: one component, water based, non-sacrificial, clear sealer consisting of blend of polymers, orango silanes, and siloxanes. Acceptable material: Fabrikem Fabrishield Paint Repellent, PR-60 for stone, PR-61 for clay brick.

E29.3 Construction Methods

E29.3.1 Sample Application

(a) Apply graffiti-resistant coating to mock-up panel specified in E16 Masonry.

(b) Do not proceed with coating work until Contract Administrator has reviewed and accepted sample application.

E29.3.2 Product Data

(a) Submit manufacturer's product data, specifications and application instructions to Contract Administrator prior to application of coatings.

E29.3.3 Environmental Conditions

(a) Maintain ambient and structural base temperature at installation area within limits specified by coating manufacturer. Apply coating during dry weather. Do not apply coating to wet or damp surfaces.

E29.3.4 Protection

(a) Protect plants and vegetation that might be damaged by coating. Protect surfaces not intended to have application of coatings. Provide adequate ventilation or isolation measures to protect against toxic fumes.

E29.3.5 Surface Preparation

(a) Prepare and clean substrate surfaces in accordance with coating manufacturer's printed instructions.

(b) Take moisture tests on substrates to receive coating to ensure moisture levels are within limits specified by coating manufacturer.

E29.3.6 Application

(a) Apply coating using low-pressure spraying apparatus, in accordance with manufacturer's instructions at manufacturer's recommended coverage rate:

(i) Stone: 175 – 225 ft²/gal.
(ii) Clay brick:175 – 225 ft²/gal.

(b) Increase coverage depending on surface porosity, absorption, and surface profile.

(c) Apply in uniform, even coats to fully wet substrate.

(d) Allow area to dry completely before applying additional coats.

E29.4 Measurement and Payment

(a) Graffiti resistant coating shall be paid for under the unit price for "Wastewater Pumping Station", which price shall be payment in full for supplying all materials and for performing

all operations herein described and all other items incidental to the work included in this Specification

E30. SWING ARM, CHAIN HOIST AND PUSH TROLLEY

E30.1 Description

(a) This Specification shall cover the design, fabrication and installation of a pre-engineered swing arm, chain hoist and push trolley on the main floor as shown on the Drawings.

(b) All parts of the pre-engineered swing arm chain hoist and trolley shall have a safe working load capacity of 1 ton.

(c) The pre-engineered swing arm hoist shall be equipped with a chain bag, and shall be able to lift an entire pump/motor unit from the pump room floor to the main floor. The designer shall limit the baseplate to a maximum size of 600mm x 600mm, and shall indicate the anchor bolt requirements on the shop drawings.

(d) The configuration of the pre-engineered swing arm shall be such that:

(i) Swing arm length = 1852 mm
(ii) Total boom length = 2172 mm
(iii) Top of swing arm height = 2440 mm
(iv) Swing radius = 180˚ (provide removable swing limiters)
(v) 120/240V single phase plug in electric 1 ton capacity hoist with 12m lift. Acceptable manufacturer: a) Budgit b)Columbus McKinnon

(e) 1 Ton capacity push trolley to suit swing are beam and electric chain hoist. Acceptable manufacturer: Budgit

E30.2 Materials

E30.2.1 Structural Steel

(a) Structural steel shall conform to the requirements of E15 Metal Fabrications.

E30.2.2 Paint

(a) Paint shall conform to the requirements of E28 Painting.

E30.3 Construction Methods

E30.3.1 Structural Steel

(a) Structural steel shall conform to the requirements of E15 Metal Fabrications.

E33.3.2 Painting

(a) Painting shall conform to the requirements of E28 Painting.

E30.4 Measurement and Payment

(a) The design, fabrication, supply and installation of a pre-engineered swing arm hoist, and the supply and installation of a crane consisting of a chain hoist and trolley, shall be included with wastewater pumping station and paid for under the Contract Unit Price for “Wastewater Pumping Station”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E31. PULTRUDED FIBERGLASS STRUCTURAL SHAPES AND SQUARE TUBE HANDRAIL

E31.1 Description

(a) This Specification shall cover the supply, fabrication, transportation, handling, delivery and placement of all fibreglass reinforced plastics (FRP), and pultruded fiberglass handrail system in compliance with IBC 2003 and OSHA 1910-23 for industrial occupancies only.

E31.2 References

E31.2.1 Tensile Properties of Plastics:- to ASTM D-638.

E31.2.2 Flexural Properties of Unreinforced and Reinforced Plastics:- to ASTM D-790.

E31.2.3 Apparent Interlaminar Shear Strength of Parallel Fiber Composites: to ASTM D-2344.

E31.2.4 Coefficient of Linear Thermal Expansion for Plastics: to ASTM D-696.

E31.2.5 Surface Burning Characteristics of Building Materials:- to ASTM E-84.

E31.2.6 The Occupational Health and Safety Administration - Federal Register, Volume 39, No. 125, Section 1910.23.

E31.3 Materials

E31.3.1 Manufacturer

(a) Structural shapes shall be Dynaform® as manufactured by

(i) Fibergrate Composite Structures Inc.
5151 Belt Line Road, Suite 700
Dallas, Texas 75254-7028 USA
(800) 527-4043 (972) 250-1530 Fax
and distributed in Canada by:
Fibergrate Canada
95 Sunray Street
Whitby, Ontario, L1N 9C9
(800) 263-3112 (905) 430-3056 Fax

E31.3.2 All structural shapes are to be manufactured by the pultrusion process with a glass content minimum of 45%, maximum of 55% by weight. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

E31.3.3 All posts and rails are to be DYNAFORM® FRP structural shapes manufactured by the pultrusion process. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions specified in the Contract Documents.

E31.3.4 Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.

E31.3.5 Resins shall be {DYNAFORM® ISO, non-fire retardant isophthalic polyester; ISOFR, fire retardant isophthalic polyester or VEFR, fire retardant vinyl ester, (choose one)} with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.

E31.3.6 All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

E31.3.7 All pultruded structural shapes shall be further protected from ultraviolet (UV) attack with 1) integral UV inhibitors in the resin and 2) a synthetic surfacing veil to produce a resin rich surface.

E31.3.8 All FRP products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test.

E31.3.9 Top and bottom rails are to be 1.75" x 0.125" (44.4 mm x 3.2 mm) wall square tube, the posts are to be 2.125" x 0.1875" (53.9 mm x 4.8 mm) wall square tube and kickplate is to be 0.5" (12.7mm) deep x 4" (101.6 mm) wide with two reinforcing ribs.

E31.3.10 The completed handrail installation shall meet the following load requirements with a minimum factor of safety of 2.0:

E31.3.11 Concentrated Load: 200 lb (891 N) applied in any direction at the top rail.

E31.3.12 Uniform Load: 47 lb/lf (0.7 kN/m) of the top rail in any direction.

E31.3.13 Loads are assumed not to act concurrently.

E31.3.14 All rails, posts, and kick plates are to be integrally pigmented yellow.

E31.3.15 All fasteners used in the railing system are to be 316 SS. Rivets to be 18-8 SS.

E31.3.16 Pultruded structural shapes are to have the minimum longitudinal mechanical properties listed below:

Property	**ASTM Method**	**Value**	**Units**
Tensile Strength	D-638	30,000 (206)	psi (MPa)
Tensile Modulus	D-638	2.5×10^6 (17.2)	psi (GPa)
Flexural Strength	D-790	30,000 (206)	psi (MPa)
Flexural Modulus	D-790	1.8×10^6 (12.4)	psi (GPa)
Flexural Modulus (Full Section)	N/A	2.8×10^6 (19.3)	psi (GPa)
Short Beam Shear (Transverse)	D-2344	4,500 (31)	psi (MPa)
Shear Modulus (Transverse)	N/A	4.5×10^5 (3.1)	psi (GPa)
Coefficient of Thermal Expansion	D-696	4.4×10^{-6} (8.0×10^{-6})	in/in/℉ (cm/cm/℃)
Flame Spread	E-84	25 or less	N/A

E31.4 Submittals

(a) Provide shop drawings of all fabricated structural systems and accessories in accordance with the provisions of this Section.

(b) Shop drawings should clearly show material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.

(c) Submit the manufacturer's published literature including structural design data, structural properties data, corrosion resistance tables, certificates of compliance, test reports as applicable, and design calculations for systems not sized or designed in the contract documents, and sealed by a Professional Engineer registered to practice in the Province of Manitoba.

(d) Provide sample pieces of each item specified herein for acceptance by the Contract Administrator as to quality and color. Sample pieces shall be manufactured by the method to be used in the Work.

E31.5 Construction

E31.5.1 Quality Assurance

(a) All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.

(b) Manufacturer shall offer a 3 year limited warranty on all FRP products against defects in materials and workmanship.

(c) Manufacturer shall be certified to the ISO 9001-2000 standard.

(d) Manufacturer shall provide proof of certification from at least two other quality assurance programs for its facilities or products (UL, DNV, ABS, USCG, AARR).

E31.5.2 Product Delivery and Storage

(a) Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

(b) All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, and other types of damage. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

E31.5.3 Fabrication

(a) Structural Shapes supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by manufacturer to complete the work. Determine correct size and locations of required holes or coping from field dimensions before structural shape fabrication.

(b) All shop fabricated cuts or drilling shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated cuts or drilling shall be coated similarly by the Contractor in accordance with the manufacturer's instructions.

(c) Type 316 stainless steel bolts shall be provided.

(d) The handrail post/rail connection is to be fabricated such that the rails are unbroken and continuous through the post without the use of packs or splices. The bottom rail is to be installed through the post at a prepared hole made to fit the outside dimensions of the rail. The top rail is to fit into a machined, u-shaped pocket formed into top of the post such that

the rail is located at the center of the post. All exposed post corners are to be radiused to eliminate sharp edges. The rails are to be joined to the post through a combination of bonding and riveting. No sharp, protruding edges are to remain after assembly of the handrail. Spacing of the posts shall not exceed 5'-0" (1.52 m).

(e) The bases of the posts are to be attached according to the contract drawings. The bases of the posts are to be reinforced to a height of 8.5" (254 mm).

(f) When required, rails are to be spliced using a 10" (152.4 mm) length of 1.5" x 1/8" (38.1 mm x 3.2 mm) FRP square tube bonded and riveted into place using epoxy adhesive and 18-8 stainless steel rivets.

(g) To avoid embrittlement at cold temperatures and loss of strength at high temperatures, no PVC or CPVC connectors should be used as a load carrying component of the handrail system.

E31.5.4 Inspection

(a) Shop inspection is authorized as required by the Contract Administrator and shall be at the Contractor's expense. The fabricator shall give ample notice to Contractor prior to the beginning of any fabrication work so that inspection may be provided. The structural shapes shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

E31.6 Measurement and Payment

(a) Pultruded fibreglass structural shapes and square tube handrail, shall be included with wastewater pumping station and paid for under the Contract Unit Price for "Wastewater Pumping Station", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E32. VENTILATION

E32.1 Description

(a) Work to include all labour, plant, tools, materials, equipment and services necessary and reasonable incidental to complete installation of the ventilation system.

E32.2 Materials

E32.2.1 Pumping Station Ventilation Fans

(b) Provide centrifugal inline bolt-driven supply and exhaust fans c/w spring vibration isolation hangers and two speed motors, refer to fan schedule on drawing 7501.

(c) Acceptable materials: Greenheck BSQ or approved equal in accordance with B6.
.

(d) Low Pressure Duct Sealer: Apply Duro-Dyne S-2 duct sealer, to all outside air, supply and exhaust ducts.

E32.2.2 Low Pressure Ductwork

(a) Galvanized Iron Schedule (rectangular duct work):

Max Side	Gauge (mm)	Bracing	
(i)	Up to 600 mm	0.60	None
(ii)	635 to 750mm	0.60	25mmx25mmx3.2mm angle, 1200mm from joint
(iii)	785 to 1000mm	0.80	25mmx25mmx3.2mm angle, 1200mm from joint

(a) Galvanized Iron Schedule (round duct work):

(b) Sizes up to 450 mm to be zinc coated steel strip, spiral 0.60mm (24 ga) with ribs spaced 6" apart.

(c) PVC round duct (wet well vent duct) to be ASTM D3034 SDR 35 PVC.

E32.2.3 Louvres and Wall Openings

(a) Provide Airolite K605x rain louvres as shown and/or specified including inlets and outlets complete with manual opposed blade dampers 13 mm square mesh, 1.6 mm aluminum birdscreening with standard formed U-frame.

E32.2.4 Duct Openings

(a) Locate only openings in walls, floors, partitions, beams, etc. required for ducts, equipment, etc. G.C. to form all openings for same, except as noted. Pack area between ducts and openings with fireproof self-supporting insulation. Seal with 25 mm mastic topping. Seal airtight, openings around ducts, pipes, etc.

E32.2.5 Electric Duct Heaters (C/W Scr Controller)

(a) Supply where indicated CSA approved electric duct heaters as manufactured by Thermolec Manufacturing Ltd.

(b) Coils shall be iron-free, 80% nickel, 20% chrome and shall be insulated by floating ceramic bushing from the steel frame which shall be galvanized or aluminized. Coil terminal pins shall be insulated by means of non-rotating ceramic bushing.

(c) Duct heaters shall be equipped with both automatic and manual reset disc type thermal cut-outs and power terminal block.

(d) Thermal Safety Cut-outs shall be shielded from accidental impact and be serviceable through a side mounted terminal box. Each individual cut-out shall de-energize the entire heater in case of overheating.

(e) Duct heaters shall be non-sensitive to air flow direction and interchangeable for horizontal or vertical ducts. Frame shall be type FC flanged or type SC side duct slip-in to facilitate ease of installation and servicing.

(f) Duct heaters shall be complete with integral S.C.R. and driver. The SCR shall be c/w active transient energy protection feature to protect semiconductor components from transient line high voltage spikes.

(g) Include: 24 VAC, D-45 step controller, TransAX protection feature, remote wall mounted thermostat, air proving pressure differential switch, inlet debris screen, 24 V internal control transformer and contactors. Control panel shall be c/w full line break disconnect switch. Sizes and quantities as indicated in schedule.

(h) Watt density not to exceed 242 kW/sq. m. (22.5 kW per sq. ft.).

E32.3 Construction Methods

E32.3.1 Low Pressure Ductwork

(a) Duct sizes are inside dimensions.

(b) Construct rectangular ducts by breaking corners, grooving longitudinal seams, using Pittsburg or other approved airtight seam. Elbows and transformation pieces to have Pittsburg corner or double seam corners. Transverse joints to have S-Slips, Bar Slips, Drive Slips, etc. as recommended in ASHRAE Guide. Slips to be one gauge heavier than duct material. Open corners not accepted. Laps to be in air flow direction. Use rivets and bolts throughout. Hammer edges and slips for smooth interior duct. Construct tees, bends, and elbows with radius 2 widths of ducts on centre line.

(c) Adequately brace and support to provide good installation.

(d) Prior to application, clean and degrease ductwork. Use 6.4 mm bead of sealer at all seams and joints.

E32.3.2 Wall Openings

(a) Flash and make all openings around the duct and wall openings weathertight. Slope ductwork down to openings. Seal ductwork with Duro-Dyne S-2 until watertight.

E32.3.3 Fans

(a) Comply with manufacturers requirements. Ensure vibration free installation. Leave access for servicing. Install belt guards as required.

(b) Vibration and Objectionable Noises, install ductwork free from pulsation, chatter, vibration or objectionable noises. Should any of these defects appear after the system is in operation, correct same by removing, replacing, or reinforcing the work as directed by the Contract Administrator.

E32.3.4 Measurement and Payment

(a) Ventilation will be measured on a Unit basis and paid for at the Contract Unit Price for "Ventilation Work", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E33. INSULATION

E33.1 Description

(a) Work to include all labour, plant, tools, material, equipment and services necessary and reasonably incidental to completion of external insulation for mechanical equipment and ductwork.

E33.2 Materials

(a) All materials shall be equivalent in all respects to specified products and shall be used only in applications intended by the manufacturer. Materials not specifically intended for the purpose shall not be used. Approved materials shall not be diluted or blended with other materials unless specifically recommended by the manufacturer of the approved material.

(b) All final pipe and duct installations including insulation, covering and adhesive shall have a ULC Certified flame spread rating of not greater than 25, and a smoke developed classification of not more than 50.

(c) All canvas shall be treated to be fire retardant in accordance with ULC standards.

(d) Contract Administrator reserves the right to demand test samples of components of insulation systems for fire hazard test rating.

E33.2.1 Vapour Barrier Flexible Duct Insulation

(a) Following duct externally insulated with Fiberglass RFFRK reinforced foil-faced vapour seal duct insulation PF335, 340 g. (3/4 lb. / cu. ft.) density.

(b) 50mm (2") Thickness

(i) All exhaust and relief ducts, from roof or wall back for a length of 1.8m (6'-0") or from wall or roof discharge back to damper, whichever is greater.
(ii) All outside air ductwork up stream of heating coil.
(iii) All dust collector ductwork from wall or roof back into building for distance of 1.8m (6'-0").

E33.2.2 Canvas Insulation Jacket

(a) All insulated ductwork shall be wrapped with fire retardant paper recovered with 170 g. (6 oz.) canvas secured with Bakor 120-18 white fire retardant lagging. Brush coat with same adhesive. Do not use staples.

E33.3 Construction Methods

(a) Rectangular Ductwork

(i) On ducts 600mm (24") wide and wider apply fasteners to bottom surface of duct by impaling on welded pins on 300mm (12") centers. Spot adhesive on 300mm (12") centers on all sides of duct. Apply insulation with edges tightly butted together and secured with 100% coverage of 3-M No. 17 or approved alternate. Staple joints and seal with 100mm (4") strips of vapor barrier foil of same quality as duct insulation membrane sealed with BF85-15.

(ii) On ducts 575mm (23") wide or less insulation applied as above but welded pins may be omitted.

(b) Round Ducts

(i) Adhere to duct surface applied in strips 150mm (6") wide, 300mm (12") o.c. Butt all edges of insulation, staple and seal all joints with tape adhered over the joint. Seal all breaks with vapor barrier type.

E33.4 Measurement and Payment

(a) Insulation shall be included with ventilation and paid for under the Contract Unit Price for “Ventilation Work”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E34. ELECTRICAL

E34.1 General

E34.1.1 Description

(a) This work shall consist of furnishing of all labour, material, equipment and all incidentals required for the new Wastewater Pump Station and associated works.

(b) Work shall include, but not be limited to:

(i) Provision of new electrical system as required.

(ii) Wire to and make connections to, all electrical power and control items required, including motors, controls, equipment, switches and receptacles.

(c) All work to be carried out by qualified journeymen of the related trades.

(d) Install to make a complete and working system.

(e) Make all arrangements and co-ordinate with Hydro Supply Authority to ensure availability of service when required.

(f) Arrange for and coordinate rough-in and final inspections with Authority having jurisdiction, Consultant and local Authorities.

(g) Obtain all permits, approvals and pay all related fees required for complete installations.

E34.1.2 Abbreviations

(a) Abbreviations for electrical terms shall be to CSA Z85-1983.

(b) Names used throughout these specifications are:

(i)	EEMAC (formerly CEMA)	Electrical and Electronic Manufacturers Association of Canada
(ii)	CSA	Canadian Standards Association
(iii)	FM	Factory Mutual
(iv)	NEMA	National Electrical Manufacturers Association (U.S.)
(v)	JIC	Joint Industry Conference
(vi)	IPCEA	Insulated Power Cable Engineers Association
(vii)	ISA	Instrument Society of America
(viii)	CEC	Canadian Electrical Code
(ix)	IEEE	Institute of Electrical and Electronic Engineers
(x)	IES	Illuminating Engineering Society
(xi)	NBC	National Building Code
(xii)	ANSI	American National Standards Institute

E34.1.3 Definitions

(a) The following are definitions of terms and expressions used in the specification:

(i) "Inspection Authority" means agent of any authority having jurisdiction over construction and safety standards associated with any part of electrical work on site.
(ii) "Supply Authority" means electrical power company or commission responsible for delivery of electrical power to project.
(iii) "Electrical Code" means Canadian Electrical Code C22.1 or code in force at project location.
(iv) "Indicated" means as shown on contract drawings or noted in contract documents.

(b) Refer to CSA C22.2 No.0 for "Definitions and General Requirements".

E34.2 Materials

E34.2.1 Approved Design

(a) Equipment and material to be of approved design and manufactured in accordance with all governing regulations such as "Canadian Standards Association", "Canadian Electrical Code", "Provincial Department of Labour", "Underwriters Laboratory", etc. Equipment and material must bear applicable acceptance labels of all associations and governing bodies recognized by the municipal, provincial and federal authorities.

E34.2.2 Shop Drawings

(a) Submit shop drawings for all equipment with the exception of conduit, standard conduit fittings and low voltage wiring in accordance with this section and E6.

(b) Indicate on shop drawings details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

(c) Where applicable, include wiring, single line and schematic diagrams.

(d) Wiring drawings showing interconnection with work of other divisions are required.

(e) Indicate the number or letter used as an identification symbol on product data for panelboards, lighting fixtures and other equipment.

(f) Contractor shall be responsible for all necessary changes, modifications, etc, as may be required to equipment fabricated prior to shop drawing approval.

E34.2.3 Products - General

(a) All materials shall be fully approved by the Canadian Standards Association (CSA) for use as installed and meet the requirements of this specification in all respects.

(b) Where two or more units of the same class or type of equipment are required, the units shall be the product of a single manufacturer, although components of equipment need not be products of the same manufacturer, they are to be NEMA rated.

(c) Use material and equipment available from regular production of manufacturer.

(d) Control panels and component assemblies to be shop manufactured and NEMA rated.

E34.2.4 Enclosures

(a) Minimum enclosure type to be used is EEMAC 12 unless otherwise specified.

E34.2.5 Wire and Cable

(a) All wire shall have stranded, annealed copper conductors, 600 volt rating, cross-linked polyethylene (XLPE) insulation, minus 40ºC, 90ºC maximum conductor temperature, limited flame spread.

(b) The wiring shall be suitable for installation in wet environment and rated RW-90. Service entrance cables shall be core flex RA90.

(c) For direct buried installations or for installation in direct buried polyethylene pipe, the cable shall be cross linked polyethylene, rated RWU-90.

(d) Minimum conductor size shall be #12 AWG unless otherwise specified. #14 AWG may be used for control wiring.

(e) Use GTF fixture wire, 600 volt, 125 C, flexible copper conductor for all connections between lighting fixtures and outlet boxes.

(f) Colour coding of insulated conductors shall conform to the following:

(i) Single Phase Systems

a. Phase A Red
b. Phase B Black
c. Neutral White
d. Ground Green

(ii) Three Phase Four Wire Systems

a. Phase A Red
b. Phase B Black
c. Phase C Blue
d. Neutral White
e. Ground Green

(g) Insulated ground conductors forming part of a multi-conductor cable assembly shall have green colour coding. Cable and wire shall be as manufactured by Alcatel Canada Wire Inc., Phillips Cables Ltd., Pirelli Cables Inc., or approved equal in accordance with B6.
.

(h) Make connections to equipment "pig-tails" with mechanical, insulated, screw-on connectors for wire sizes #14-10 AWG. For wire sizes #8 AWG and larger utilize split-bolt connectors, taped with three layers minimum of insulating tape.

E34.2.6 Wiring Accessories

(a) Wire markers, black letters on white background, shall be heat shrink permanent indelible type as manufactured by Kroy, Critchley or approved equal in accordance with B6.
.

(b) Cable markers for cables or conductors greater than 13 mm (1/2 inch) diameter, shall be strap-on type, rigid PVC, black letters on white background, with PVC covered aluminum straps, as manufactured by Electrovert Cat. No. 510 or approved equal in accordance with B6. Terminal Blocks are to be identified and labelled.

(c) Terminal blocks shall be minimum 600 volt rated, modular, sized to accommodate conductor size used, as manufactured by Weidmuller, Entrelac or approved equal in accordance with B6.

(d) Where screw-type terminals are provided on equipment, field wiring shall be terminated with insulated fork tongue terminals, as manufactured by Thomas and Betts, Sta-Kon or approved equal in accordance with B6.

(e) Splice connectors for wire sizes #14-10 AWG inclusive, shall be of the compression spring type, as manufactured by Ideal Waterproof Type DP plus or approved equal in accordance with B6.

(f) Splice connectors for wire sizes #8 AWG and larger shall be split-bolt type, sized to suit number and size of conductors, as manufactured by Burndy Servit Type KS or approved equal in accordance with B6.

(g) Cable ties shall be nylon, one-piece, self-locking type, as manufactured by Thomas and Betts, Burndy, Electrovert or approved equal in accordance with B6.

(h) Electrical insulating tape as manufactured by 3M Scotch 88 or approved equal in accordance with B6.

(i) The cable grips shall be selected to accommodate the type and geometry of cable supported and shall be of the single wave, variable mesh design, as manufactured by Kellems, Arrow-Hart or approved equal in accordance with B6. Cable pulling lubricant shall be compatible with cable covering and shall not cause damage and corrosion to conduits or ducts.

E34.2.7 Wire and Box Connectors

(a) Solder lugs to CSA C22.2 No. 19-1935 (R1981). Wire connectors to CSA C22.2 No. 65-M1988. Connectors shall be copper or copper alloy. Bushing stud connectors to EEMAC 1Y-2-1961 and shall be suited for conductor type. Clamps or connectors for cable to CSA-C22.2 No. 18, 1972.

(b) All lugs, terminals and screws used for termination of wiring must be suitable for copper conductors.

(c) Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

(d) Fixture type splicing connectors: with current carrying parts of copper sized to fit copper 10 AWG or less.

(e) Clamps or connectors for flexible conduit, as required.

(f) All cable terminations shall be with compression type connectors.

E34.2.8 Fastenings and Support

(a) All fastenings used in the Pumping Station shall be corrosion resistant stainless steel.

(b) Power-actuated fasteners and devices shall not be used.

(c) Support channels, length as required, U shaped, size as required, of stainless steel.

(d) Support equipment, conduit or cable clips, spring loaded bolts and cable clamps, to be purpose-built accessories to basic channel members.

E34.2.9 Outlet Boxes

(a) Size boxes in accordance with CSA C22.1-1998.

(b) 100 mm square or larger outlet boxes as required for special devices.

(c) Gang boxes where wiring devices are grouped.

(d) Blank cover plates for boxes without wiring devices.

(e) Outlet boxes to be PVC.

(f) All outlet boxes shall be supplied with ground stud.

(g) Outlet boxes to be Series FS or FD as manufactured by Ipex or approved equal in accordance with B6.

(h) Surface mounted outlet boxes shall be EEMAC 4X unless otherwise indicated.

(i) All outlet boxes to CSA C22.2 No. 18-M1987.

E34.2.10 Receptacles

(a) Type EEMAC 5-15R, 125V, 15A, U-ground, heavy duty specification grade to CSA C22.2 No. 42-M1984.

(b) Receptacle shall have heavy duty nylon face with steel reinforcing plate in centre.

(c) Receptacle shall have spring loaded back wiring.

(d) Receptacle shall have raised ground for safety.

(e) Receptacle contacts shall have spring steel clips to reduce contact fatigue.

(f) Receptacle shall be suitable for No. 10 AWG back and side wiring.

(g) All screws shall be combination slotted socket head design to accept #6 socket head screwdriver on all screws.

(h) Acceptable manufacturer is Hubbell 8200 duplex receptacle or approved equal in accordance with B6 and Hubbel GF8200 for GFI receptacles.

E34.2.11 Switches

(a) Switches shall be 15A, 120V, single pole, double pole, or three way as indicated on the Drawings.

(b) Must adhere to CSA 22.2 No. 111-M1986.

(c) Switches to be manually-operated heavy duty with the following features:

(i) Heavy duty mounting strap
(ii) One piece Lexan toggle, lever, and cam

(iii) Silver alloy contacts
(iv) Spring loaded back wired
(v) Green hex head grounding terminal

(d) All screws socket/slotted head suited to accommodate #6 socket head screwdriver.

(e) Switches to be fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

(f) Acceptable manufacturer is Arrow Hart No. 1201 (number to suit application and amperage) or approved equal in accordance with B6.

(g) Acceptable manufacturer for welding receptacle is Crouse Hinds No. AR642 c/w ARE 36 back box.

E34.2.12 Cover Plates

(a) Cover plates from one manufacturer throughout project to match switches and receptacles.

(b) Cover plates to be PVC.

(c) For wiring devices mounted in flush-mounted outlet boxes, thickness to be 2.5 mm.

(d) Cover plates shall be suitable for Ipex FS/FD boxes.

(e) Weatherproof covers for duplex receptacles shall be self closing, two spring loaded independent doors, PVC complete with non-corrosion stainless steel springs and stainless steel mounting screws.

(f) Weatherproof covers for light switches shall be plunger style, PVC complete with non-corrosive stainless steel mounting screws.

(g) Weatherproof covers shall be complete with EPDM gasketry material suitable for -45°C to 85°C.

(h) Acceptable manufacturers are IPEX or approved equal in accordance with B6.

E34.2.13 Disconnect Switches

(a) Provide unfused disconnect switches rated to suit loads.

(b) Disconnect shall be front-operational, heavy duty, industrial grade, quick-make, quick-break type.

(c) Make provision for padlocking in the "OFF" position.

(d) Mechanically interlocked door to prevent opening when handle in "ON" position.

(e) "ON/OFF" switch position indication in switch enclosure cover.

(f) Disconnect enclosures shall be EEMAC 12 unless otherwise indicated.

(g) Disconnects for all equipment specified shall be as manufactured by Arrow Hart AH series, Cutler-Hammer HD series, Schneider Canada Square “D” CHU series or approved equal in accordance with B6.

E34.2.14 Grounding

(a) The grounding system shall include ground rods, all wiring, ground bus, thermit welds, mechanical fittings, connectors, links and miscellaneous materials necessary to complete a grounding system acceptable to the Authority having Jurisdiction and Manitoba Hydro.

(b) Grounding equipment to CSA C22.2 No. 41-M1987. Copper grounding conductors to ASA A7.1 1964.

(c) Ground conductors shall be concentric stranded, soft drawn copper. Insulated conductors, where required by Inspection Authorities or specified, shall be type TW, 600 volt rating, green colour.

(d) Where direct buried bare ground conductor comes into contact with corrosive material, the conductor shall be tinned.

(e) Ground bus in Motor Control Centre shall be copper, minimum 6 mm x 50 mm cross-section.

(f) Compression devices shall be of pure wrought copper material, factory fitted with oxide inhibiting compound and shall meet latest IEEE 80 Standard, as manufactured by T and B, Burndy or approved equal in accordance with B6.

(g) Mechanical connectors shall be of bronze, copper or brass construction with stainless steel hardware selected and sized specifically for the particular application and shall meet latest IEEE standard.

(h) Ground rods shall be 19 mm diameter, 3 m long, copper clad steel construction with the copper exterior coating permanently bonded to the steel core.

E34.2.15 Dry Type Transformers

(a) To CSA C22.2 No. 47-1961 and C9-1966. To C.E.C. Section 26-260 "Marking of Transformers."

(b) Submit shop drawings in accordance with this section including:

(i) Voltage ranges and taps
(ii) kVA rating
(iii) Mounting configurations
(iv) Weight
(v) Cable terminal sizes
(vi) Nameplate data.

(c) Use transformers of one manufacturer throughout project.

(d) Transformers to have the following characteristics:

(i) Type: ANN
(ii) Three phase, 600V primary, 120/208V secondary
(iii) kVA rating as indicated on drawings
(iv) Operating frequency of 60 Hz
(v) Winding insulation of 1000 V class, 115 degree temperature rise
(vi) Maximum impedance of 5%
(vii) Sound rating of 40 dB
(viii) Basic Impulse Level (BIL) is standard
(ix) Hipot is standard
(x) Taps 4 - 2 ½ percent FCAN, FCBN
(xi) Air ventilated via louvres
(xii) Termination at bottom of transformer
(xiii) Finish shall be ASA 61 grey
(xiv) Located in the MCC
(xv) Epoxy-filled
(xvi) Fused primary and secondary

(e) Acceptable manufacturer is Hammond, Square "D", Marcus or approved equal in accordance with B6.

E34.2.16 Panelboards

(a) All equipment to CSA Standard C22.2 No. 29-M1989.

(b) Fault current ratings to be indicated on nameplates.

(c) Install circuit breakers in panelboards before shipment.

(d) All panelboards shall be supplied by one manufacturer.

(e) Panelboard mains, number of circuits, and number and size of branch circuit breakers shall be as indicated on the drawings.

(f) 120/208V, 3 phase, 4 wire distribution panelboard bus and breakers to be rated 10,000 amps interrupting.

(g) 600V, 3 phase, 3 wire power panelboard bus and breakers to be rated 25,000 amps (symmetrical) interrupting capacity.

(h) The main bus bars shall tin-plated be copper and shall be equipped with solderless lugs for incoming cables. Neutral to be of same ampere rating as mains.

(i) Panelboard assemblies shall be mounted within the MCC.

(j) Doors shall have spring hatches and cylinder locks, and all locks shall be keyed alike with two keys per panelboard.

(k) Distribution panelboard acceptable manufacturer shall be Cutler-Hammer Pow-R-Line, Schneider Canada Square “D” type NQOB or approved equal in accordance with B6.

(l) Power panelboard acceptable manufacturer shall be Cultler Hammer Pow-R-Line, Schneider Canada Square “D” type NYOB or approved equal in accordance with B6.

(m) Refer to E34.2.17 Moulded Case Circuit Breakers for breaker specification.

(n) Breakers shall be numbered with odd numbers on left and even numbers on right sides of the panel.

(o) Breakers shall be the bolt-on type and shall provide instantaneous trip on over-currents and time-delay trip on overloads.

(p) Breakers shall be compatible with fault current rating of the panel.

(q) Breakers shall be of the thermal magnetic tripping type.

E34.2.17 Moulded Case Circuit Breakers

(a) All equipment to CSA Standard 22.2, No. 5-M1986.

(b) Specific circuit breaker voltage, phase ampacity, interrupting capacity, breaker type and setting are indicated elsewhere in the Specifications or on the Drawings.

(c) Submit shop drawings in accordance with this section including component function, make and model number.

(d) Submit time-current characteristic curves for breakers with ampacity of 15 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

(e) Bolt-on moulded case circuit breakers, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

(f) Common-trip breakers with single handle for multipole applications.

(g) Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-10 times current rating.

(h) Circuit breakers with interchangeable trips as indicated.

(i) Thermal magnetic circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping.

(j) Magnetic circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection (motor starters).

(k) For circuit breakers protecting fans, heating elements, transformers and panelboards, acceptable manufacturer is Cutler-Hammer Series C Moulded Case Circuit Breaker, Schneider Canada, Square D FHL Moulded Case Circuit Breaker or approved equal in accordance with B6.

(l) For circuit breakers protecting electric motors, acceptable manufacturer is Cutler-Hammer Series C HMCP Motor Circuit Protector, Schneider Canada, Square “D” Mag-Guard Motor Circuit Protector or approved equal in accordance with B6.

E34.2.18 Lighting Fixtures

(a) All fixtures shall carry the approval of the Canadian Standards Association and the approval of the Inspection Department having jurisdiction. Fluorescent fixture ballasts shall be T8 electronic type and must be listed by Manitoba Hydro as acceptable by their Power Smart rebate program.

(b) All fixtures, stem hangers, ballast compartments, canopies, reflectors, wireways and brackets, used in conjunction with the fixtures shall be factory finished, baked white enamel, unless otherwise specified.

(c) Fluorescent lamps shall be T8 with minimum CRI85, 3500 deg.K colour.

(d) Metal Halide lamps shall be rated as indicated, medium or mogul screw base, initial lumens as follows:

(i) 70 Watts: 6000
(ii) Average rated life 24000 hrs.

(e) Type "A" fixture shall be surface or wall mounted wraparound fluorescent fixture, fibreglass, enclosed and gasketted, moisture and corrosion resistant complete with 2- 32WT8 lamps.

(f) LITHONIA VDS Series or approved equal in accordance with B6.

(g) As per C.E.C. Section 22 and Section 30.

E34.2.19 Fluorescent Ballasts

(a) Fluorescent ballasts shall be CSA and CBM certified electronics.

(b) Designed for the operation of lamps in the lighting fixtures as specified, rated 120 volts, 60Hz integrated circuit design for use with one or two F32T8 lamps as indicated.

(c) Designed to provide over 95% power factor with 95% of rated lamp lumen.

(d) Non PCB, thermally protected capacitor.

(e) Class P, automatic reset thermal protector.

(i) Input:
a. 2-lamp, maximum 65W

(f) Class A sound rating.

(g) Total harmonic distortion less than 10%.

(h) Shall meet FCC limits on EM and RF interference.

(i) Three year warranty from date of substantial completion.

(j) Listed by Manitoba Hydro as acceptable by their Power Smart Program.

E34.2.20 Metal Halide Ballasts

(a) Metal Halide ballasts to ANSI C82.4 – 1985.

(b) Voltage rating as indicated, totally enclosed and designed for 40ºC ambient temperature.

(c) Designed to provide minimum 95% power factor with 95% of the rated lamp lumen.

(d) Non PCB capacitor.

(e) Plus 10% to minus 10% of nominal input voltage range.

(f) Minimum starting temperature –34°C at 90% line voltage.

(g) Mounting as indicated.

E34.2.21 Exit Lights

(a) Housing: Metal, fully enclosed, sealed and gasketted.

(b) Lamps: LED c/w internally mounted transformer as required, 120 VAC rated.

(c) Built-in switch-over relays for 12 Volt DC operation.

(d) Shall comply with CSA-860.

(e) Lumacell LMCE Series or approved equal in accordance with B6.

E34.2.22 Emergency Lighting Battery Bank

(a) Supply voltage: 120 V ac. as indicated.

(b) Output voltage: 24 V dc. as indicated.

(c) Operating time: 120 min. as indicated.

(d) Battery: sealed, long life, lead acid or lead calcium maintenance free.

(e) Charger: solid state, multi-rate, pulse type, voltage/current regulated, inverse temperature compensated, short circuit protected, modular construction.

(f) Solid state transfer.

(g) Low voltage disconnect: solid state, modular, operates at 80% battery output voltage c/w 2-fused DC output circuits.

(h) Signal lights: solid state, life expectancy 100,000 h minimum, for 'AC Power ON' and 'High Charge'.

(i) Lamp heads: integral on unit 360 deg. horizontal and 180 deg. vertical adjustment. Lamp type: tungsten, 18 W, glare free.

(j) Cabinet: Metal-reinforced housing, fully self contained, sealed and gasketted.

(k) Auxiliary equipment:

(i) Low voltage disconnect switch.
(ii) Lamp disconnect switch.
(iii) Test switch.
(iv) Time delay relay.
(v) Battery disconnect device.
(vi) ac input and dc output terminal blocks inside cabinet.
(vii) Cord and 3-prong straight blade NEMA 5-15P plug connection for

(l) Wall mounted battery bank to be direct wall mounted or with wall mounting shelf. Provide removable or hinged front panel for easy access to the batteries. LED diagnostics display and test switch mounted by side of enclosure.

(m) Lumacell RGS Series or approved equal in accordance with B6.

(n) Remote heads to be weatherproof fixtures, double head Tungsten 24V, 18 Watt each head.

(o) Lumacell MT/MQ/MQM Series or approved equal in accordance with B6.

E34.2.23 Thermostats

(a) Provide low building temperature and ventilation system control thermostats. Acceptable manufacturer shall be Honeywell No. T631A and No. T86A or approved equal in accordance with B6.

E34.2.24 Motor Starters

(a) Motor starters are to be NEMA rated.

(b) Submit shop drawings in accordance with this section. Indicate:

(i) Mounting method and dimensions.
(ii) Starter size and type.
(iii) Layout of identified internal and front panel components.
(iv) Enclosure types.
(v) Wiring diagram for each type of starter.
(vi) Interconnection diagrams.

(c) EEMAC North American Standards to apply.

(i) Starters: EEMAC E140-1.
(ii) Half size starters not acceptable.
(iii) Smallest size starter to be size 1.
(iv) IEC rated starters are NOT acceptable.
(v) Open wound starters or relay coils not allowed.
(vi) All coils to be epoxy potted.

(d) Provide a listed spare parts for each different size and type of starter:

(i) 2 sets of contacts, stationary.
(ii) 2 sets of contacts, movable.
(iii) 1 set of contacts, auxiliary.
(iv) 1 control transformer for each VA rating supplied.
(v) 1 operating coil for each starter size supplied.
(vi) 2 fuses of each rating.
(vii) 4 indicating lamps, for each type supplied.

(e) Solid State Soft Start / Soft Stop Starters

(i) Approved Product Solid-state starters to be:
   a. Manufacturer: Benshaw
   b. Model No.: RB2-3-S30-600-H-04-NC-OP

(ii) Solid State Starters shall be complete with the following:
   a. Integrated card mounted display LED 4 digit 7 segment Status and Diagnostics,
   b. Remote 120 VAC start / stop control provisions,
   c. Control terminals for an Across The Line Operation
      (i) ATL Overload Protection (SPE-822-5a W/150:5 Current transformers)
      (ii) 11A1 – Two Pole Relay
      (iii) 2N/O, 2 N/C, Form C, Silver Cadmuim Oxide Tips. 120 VAC, 10 A Res., 7A Ind., 2.5VA (Din rail mounted)
      (iv) 3A1 – Two position Selector Switch (SS/ATL)
      (v) 10A3 – 150 VA Control Power Transformer (Fused Primary)
   d. Nema 04 Outdoor Enclosure (Wall Mount, Polyester Powder Coated Beige Paint, 14 Gauge Fully Welded Cosntruction)
   e. Line Power Top Entry Terminals, Load Power Bottom Exit Pads.
   f. Auxiliary contacts for remote indication.
   g. HOA switch
   h. Control transformer
   i. Field terminal strip and spares

(f) Accessories:

(i) Pushbuttons and selector switches: Standard heavy duty oil tight labelled as indicated.

(ii) Indicating lights: Push-to-test transformer heavy duty oil tight type and colour as indicated.

(iii) 2-N/O and 2-N/C spare auxiliary contact unless otherwise indicated.

(g) Wiring and schematic diagram inside starter enclosure in a visible location.

(h) Power and control terminal blocks as manufactured by Weidmuller SAK Series, Entrelac or approved equal in accordance with B6.

(i) Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram, as per wiring accessories.

(j) MCC:

(i) Combination type starters to include motor circuit protector with operating lever on outside of enclosure to control motor circuit protector and provision for:

   a. Locking in "OFF" position with up to 3 padlocks.
   b. Locking in "ON" position.
   c. Independent locking of enclosure door.
   d. Provision for preventing switching to "ON" position while enclosure door open.

(k) Starter sizes shall be CEC and NEMA rated suitable to applied HP rating as indicated on Drawings.

(l) Acceptable manufacturer is Square “D”, Cutler-Hammer type W960 or approved equal in accordance with B6.

(m) Single phase, dry type, control transformer with 600 volt primary voltage and 120 V secondary, complete with primary and secondary fuse, installed in with starter as indicated. Size control transformer for control circuit load required plus 100% spare capacity.

E34.2.25 Motor Control Centre

(a) Motor Control Centre general description:

(i) Compartmentalized vertical sections with common power busbars.

(ii) Floor mounting, free standing, enclosed dead front.
(iii) Accommodating incoming cable to enter at top as indicated.
(iv) Class 2, Type C.
(v) Motor circuit protector combination starters.
(vi) Sprinkler proof EEMAC 12 enclosure.

(b) Vertical section construction:

(i) Independent vertical sections fabricated from rolled flat steel sheets, bolted together to form rigid, completely enclosed assembly.
(ii) Each vertical section divided into compartment units, minimum 305 mm high.
(iii) Each unit to have complete top and bottom steel plate for isolation between units.
(iv) Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.
(v) Vertical wireways 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.
(vi) Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.
(vii) Provision for outgoing cables to exit via top and bottom.
(viii) Removable lift means.
(ix) Divide assembly for shipment to site, as indicated complete with hardware and instructions for re-assembly.
(x) Continuous 100 mm channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

(c) Main horizontal and branch vertical, three phase high conductivity tin plated copper busbars in separate compartment insulated self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:

(i) Main horizontal busbars: 600 A.
(ii) Branch vertical busbars: 300 A.

(d) Branch vertical busbars for distribution of power to units in vertical sections.

(e) No other cables, wires, equipment in main and branch busbar compartments.

(f) Brace bus-work to withstand effects of short-circuit current of 42 kA rms symmetrical.

(g) Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

(h) Tin plated copper bus size 50 x 6 mm extending entire width of motor control centre, located at top.

(i) Units EEMAC size 4 and smaller, circuit breaker units 225 A 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.

(j) Starter unit mounting:

i. Engaged position - unit stabbed into vertical bus.
ii. Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.
iii. Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

(k) Stab-on connectors free floating silver plated clips, self-aligning, backed up with steel springs.

(l) External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.

(m) Hinge unit doors on same side.

(n) Overload relays manually reset from front with door closed.

(o) Devices and components by one manufacturer to facilitate maintenance.

(p) All starters and contactors to have two N.O. and two N.C. spare contacts wired to terminal block.

(q) The shop installed wiring arrangement shall be as indicated. For Type B wiring, all control connections to be brought to terminal blocks within each starter compartment. Provide a minimum of 10 spare terminal blocks for #12 AWG incoming control wiring.

(r) Incoming and outgoing power cables and conduits shall enter the MCC's from the top as indicated.

(s) Provide internal power wiring from the line side of each starter to the bus stabs with a minimum of #12 AWG wire rated for 600 volt duty. Size wiring to accommodate the largest horsepower that the line starter is capable of switching.

(t) Control wiring shall be as 600 V rated, XLPE insulated, minimum #14 AWG size. Install wiring to panel doors utilizing extra flexible 49-strand conductors.

(u) All internal wiring shall employ stranded copper conductors.

(v) Identify all wiring by means of heat shrink permanent indelible type wire markers as manufactured by Critchley or Kroy fixed to each conductor at both ends.

(w) Wires shall be colour coded as follows:

(i) Control circuits – Red
(ii) Power circuits - Black

(x) Terminal blocks shall be of the compression type and shall be of modular pull-apart construction enabling unit wiring to be easily separated from the field wiring. Identify all terminal blocks with numbers identical to the wire numbers.

(y) No more than two wires shall be placed under each terminal screw.

(z) Provide pressure type cable lugs and bus adapters or extensions suitable for terminating the main incoming cable conductors. The lugs shall accommodate the number and size of cables as indicated. Cable entry shall be from the top of the MCC as indicated.

(aa) MCC Layout:

(i) Section #1

a. Service entrance rated at 400 amps, 347/600 volts, 3 phase, 4 wire complete with the following:
(i) 1 - 200 3P Main Breaker
(ii) Utility CT Chamber
(iii) TVSS c/w 15A 3P breaker
(iv) 40 3P transformer breaker
(v) 60A 3P Welder breaker

b. Instrumentation panel c/w Voltmeter 0 to 750 Volts c/w 4 position selector switch, Ammeter 0 to 300 Amps c/w 4 position selector switch. Instruments shall be equal to CUTLER-HAMMER Freedom & Advantage Series

(ii) Section #2

(i) 30kVA Transformer, dry-type, epoxy-filled, 600-120 / 208V / 3Ø / 4W
(ii) Distribution Panel A, 100A, 120/208V, 3Ø, 4W, 42 cct

(iii) Section #3

a. Starters for the following motors:
   a. Sewage Pump, SP-1, 15 HP, soft start/stop c/w Cutler-Hammer ammeter.
   b. Sewage Pump, SP-2, 15 HP, soft start/stop c/w Cutler-Hammer ammeter.
   c. 60A 3P Duct Heating Coil breaker (HC-1)

b. Starters are to be NEMA rated for across-the-line starts.

(iv) Section #4

(i) Benshaw Starter, soft start/stop; c/w manual bypass switch

(v) Control Section c/w all items indicated on the Drawings including:

a. Terminal strips (identified) for all wiring
b. Identification nameplates on all components, interior and exterior
c. Extra flexible wire to door components
d. Control relays, OMRON MK3 PN-5-S c/w PF-113A-E bases or Relco.
e. Time delay relays, OMRON H3CA series c/w bases
f. Push-to-test transformer type pilot lights, selector switches, push buttons,
g. Telemecanique XB2B series
h. Transient protectors, Leviton Model No.51020 BM
i. LED digital indicators, 4-20mA input, Precision Digital # PD690-3-16
j. Control Section c/w all items indicated on the Drawings including:

(vi) Paint motor control centre exterior ASA 61 light grey enamel and interiors white.

(vii) Acceptable Manufacturers: Cutler Hammer, Seimens, Allen Bradley or approved equal in accordance with B6.

E34.2.26 Transient Voltage Surge Suppressor - Integral to MCC

(a) Suppressors shall be component recognized in accordance with UL1449, Standard for Safety, Transient Voltage Surge Suppressors and UL 1283, Electromagnetic Interference Filters.

(b) Suppressors shall be independently tested with the category C3 high exposure waveform (20 kV - 1.2/50 us, 10 kA - 8/20 us) per ANSI/IEEE C62.41 - 1991.

(c) Suppressors shall incorporate copper bus bars for the surge current path. Small round wiring or plug-in connections shall not be used in the path for surge current diversion.

(d) Suppressors shall be constructed using surge current modules (MOV based). Each module shall be fused with user replaceable 200,000 AIR rated fuses. The status of each module shall be monitored on the front cover of the panelboard enclosure as well as on the module.

(e) Suppressors shall be equipped with an audible alarm which shall activate when any one of the surge current modules has failed. An alarm on/off switch shall be provided to silence the alarm and an alarm push-to-test switch shall be provided to test the alarm. The switches and alarm shall be located on the front cover of the panelboard enclosure. Include auxiliary contacts for remote indication.

(f) Suppressors shall meet or exceed the following criteria:

(i) Maximum single impulse current rating shall be no less than 200kA per phase.
(ii) Pulse life test: Capable of protecting against and surviving 5000 ANSI/IEEE C62.41 Category C transients without failure or degradation.
(iii) The clamping voltage shall not exceed the following:

VOLTAGE	L-N	N-G

347/600	1000	1000

(g) The suppressor shall have a response time no greater than 5 nanoseconds for any of the individual protection modes.

(h) Suppressors shall be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.

(i) Visible indication of proper suppressor connection and operation shall be provided. The indicator lights shall indicate which phase as well as which module is fully operable.

(j) Suppressors shall be manufactured in the United States or Canada. All major components shall also be of American or Canadian manufacture.

(k) Suppressors shall have a minimum EFI/RFI filtering of 34dB at 100kHz with an insertion loss ratio of 50:1 using Mil Std. 220A methodology.

(l) Suppressors shall have a five year warranty, incorporating unlimited replacements of suppressor modules if they are destroyed by transients during the warranty period.

E34.2.27 Electric Unit Heaters

(a) All heaters shall be 4800 watts, shall c/w built-in contactor and thermostat. All units shall be 208 volts plug in c/w cord and plug.

(b) Unit heater to be blower unit c/w wall/ceiling mount brackets, 4.8 kW, 208V, 1, and rated for corrosive atmosphere.

Chromalox:	HF-403G AC
Ouellet:	OCH4800WB*
Q-Mark:	BRH-482
Stelpro:	LCH48T

E34.3 Construction Methods

E34.3.1 Examination of Drawings

(a) The Electrical Drawings do not show all architectural, mechanical and structural details. All electrical schematics are shown diagrammatically unless otherwise noted. The Contractor shall review the Mechanical and Structural Drawings to obtain building dimensions and details. Verify dimensions accurately by measurements.

(b) To change the location of electrical equipment, submit a request in writing to the Contract Administrator for approval, prior to construction beginning.

E34.3.2 Installation

(a) Install equipment in strict accordance with manufacturer's recommendations and governing rules, regulations and codes.

(b) Where requirement conflict occurs, install all materials in accordance with the most severe requirements.

(c) Material installed under this Specification to be new and of uniform construction.

(d) All installation to ensure maximum headroom, minimum interference with free use of surrounding areas, and best access to equipment.

(e) Do not install cables or conduit across or along wall at an opening, route cables and conduits around openings.

(f) To deviate major service runs from the location shown on the Drawings, submit to the Contract Administrator suitable drawings showing such deviations together with reasons for deviations and obtain approval from the Contract Administrator before proceeding with the installation.

E34.3.3 Codes and Standards

(a) Install all equipment in accordance with current editions of CSA 22.1 and 22.2, including all local amendments unless otherwise specified.

(b) Perform all work in accordance with Drawings, Specifications, applicable municipal and provincial regulations, and any pertinent inspection bulletins issued by the electrical inspection or supply authority having jurisdiction over the installation. In no instance shall the standard established by the Drawings and Specification be reduced.

(c) Provide a copy of all standards referred to in this Specification for use on site.

E34.3.4 Permits, Inspections and Fees

(a) Deliver to the Contract Administrator all necessary interim and final certificates of inspection and approval which may be required by all Inspection Authorities having jurisdiction over the work, as evidence that the work installed conforms with the laws and regulations of all governing authorities.

(b) Submit copies of all plans and specifications to the authority having jurisdiction for inspections as may be required prior to commencement of work to comply with the above.

(c) Notify the Inspection Authorities in sufficient time for them to arrange to inspect work.

(d) Pay all associated fees.

E34.3.5 Operating and Maintenance Manuals

(a) Include in the manuals information based on following requirements:

(b) Operating and maintenance instructions to be sufficiently detailed with respect to design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

(c) Technical data to be in form of approved shop drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists.

(d) Advertising or sales literature is not acceptable.

(e) Provide wiring and schematic diagrams and performance curves.

(f) Include names and addresses of local suppliers for all items included in the operation and maintenance manuals.

(g) Submit six (6) complete copies of manuals and record drawings to the Contract Administrator for review. Revise initial manual as required by the Contract Administrator prior to final submission. Manuals to be indexed and tabled for ease of use.

E34.3.6 Record Drawings

(a) The Contractor shall record all changes made during construction and provide record drawings to the Contract Administrator upon completion of the work. The Contract Administrator shall track changes and keep a record for As-Built Drawings.

(b) Include with the record drawings a list for each motor indicating motor or equipment number and name, nameplate voltage, horsepower and current, the size of overload and breaker or fuse protection provided. Arc fault and PPE ratings shall be shown on the drawings.

E34.3.7 Cooperation and Coordination

(a) One Contractor for all work.

(b) Cooperate with all trades on site to ensure proper coordination of installation.

E34.3.8 Finish

(a) Finish metal enclosure surfaces by removing sharp burrs, rust and scale, cleaning, and applying rust resistant primer inside and outside with at least two coats of finish enamel.

(b) Paint all outdoor electrical equipment as directed by contract administrator finish to EEMAC-Y1.

(c) Paint all indoor switchgear and distribution enclosure "light grey" to ASA 61 grey.

(d) Clean, prime and paint exposed hangers, racks, fastenings, and other apparatuses, to prevent rusting except for galvanized components.

E34.3.9 Voltage Ratings

(a) Operating voltages to be within those defined in CSA Standard C235-1969.

(b) All motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment must be able to operate in extreme operating conditions established in above standard without damage to equipment.

E34.3.10 Wiring Terminations

(a) Lugs, terminals, screws used for termination of wiring must be suitable for copper conductors.

E34.3.11 Manufacturer’s and CSA Labels

(a) Manufacturers' nameplates and CSA labels are to be visible and legible after equipment is installed and painted.

E34.3.12 Warning Signs

(a) Provide warning signs with suitable background colour and lettering as required to meet requirements of inspection authorities and Contract Administrator. Use decal signs, minimum size 178 mm x 250 mm.

E34.3.13 Plywood Mounting Boards

(a) Surface wall mounted panelboards and other electrical equipment shall be installed on plywood mounting boards. Boards shall be pressure treated, sized to suit equipment indicated and/or implied. Use one single piece for mounting board unless size exceeds standard plywood sheet dimensions.

(b) Plywood mounting boards shall consist of 20 mm fir plywood fastened securely to wall.

(c) Plywood mounting boards, strapping and trim shall be treated with wood preservative prior to installation and painted with one coat of primer and two coats of grey enamel ASA61. Painting shall be completed before any electrical equipment is mounted on the plywood.

E34.3.14 Workmanship

(a) Where sheet metal enclosures are not provided with knockouts, Greenlee punches shall be used in all cases. Cutting torches and hole saws shall not be used for making holes.

E34.3.15 Installation

(a) Determine manufacturers' recommendations regarding storage and installation of equipment and adhere to these recommendations.

(b) Check all factory joints and tighten where necessary to ensure continuity.

E34.3.16 Mounting Heights

(a) Mounting height of equipment is given from finished floor to top of equipment.

(b) Exact mounting height of unnoted equipment must be verified with Contract Administrator before proceeding with installation.

(c) Install electrical equipment at heights listed below unless otherwise indicated. (All heights in millimetres from finished floor unless indicated):

(i)	Local Switches:	1420
(ii)	Wall Receptacles:	900
(iii)	Lighting Panels:	1800
(iv)	Cabinets:	1800
(v)	Emergency Lights:	2400 (minimum)

(d) All dimensions indicated are to the top above finished floor elevation.

E34.3.17 Special Protection

(a) Provide protection for exposed electrically energized equipment such as panel mains, outlet wiring, etc. Shield and mark all live parts "LIVE - 600 VOLTS" or with the appropriate voltage.

(b) Arrange for the installation of temporary doors or barriers for all electrical equipment. Keep these doors locked at all times except when under direct supervision.

E34.3.18 Equipment Identification

(a) Supply and install identification nameplates on all equipment such as motor starters, safety switches, panelboards, pushbutton stations, etc. and any equipment not so supplied. All nameplates shall be securely fastened to equipment with stainless steel screws.

(b) All identification nameplates, except for motors, shall be laminated phenolic with minimum 6 mm (1/4 inch) black letters on white background, the wording of which shall be identical to that on the single line diagrams and the title of the equipment controlled. Motor nameplates to be of noncorroding metal stamped or engraved with black lettering on light background.

(c) Warning nameplates shall be laminated phenolic with minimum 6 mm (1/4 inch) white letters on red background, the wording to be reviewed by the Contract Administrator. All warning nameplates to be screwed to equipment.

(d) Warning nameplates required by Inspection Authorities shall be provided for all electrical switchgear and equipment and on access doors to electrical rooms, vaults, switchyards, etc. in accordance with the applicable Code regulations. Obtain all necessary details from the Inspection Authorities.

(e) Where wording is not specified on the Drawings, obtain exact wording from the Contract Administrator.

(f) Identify pull boxes, terminal cabinets and junction boxes enclosing cables or connections with nameplates indicating voltage, box number and circuit number.

(g) Provide junction boxes, relay panels and miscellaneous equipment energized from two or more sources with a warning nameplate prominently displayed, noting number and location of sources and their voltage.

(h) Provide a typewritten circuit directory with a clear plastic cover for each panelboard in a suitable holder on the inside of each panel door. Unless otherwise noted, the directory shall indicate breaker or switch circuit number, rating, load description and associated load data. Affix clear plastic cover securely to door with adhesive. Use indelible ink to complete manufacturer's directory on door panel.

(i) Manufacturer's nameplates and CSA labels to be visible and legible after equipment is installed.

E34.3.19 Wiring Identification

(a) Provide permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and, branch circuit wiring and all other wiring. Maintain phase sequence and identification throughout system, i.e. panelboards, starters, terminal blocks, disconnect switches.

(b) Maintain identification system at all junction boxes, splitters, cabinets and outlet boxes.

(c) Use colour coded wires in communication cables, matched throughout system. All colour coding must adhere to CSA C22.1.

E34.3.20 Touch-Up Painting

(a) Be responsible for field touch-up painting of all shop painted electrical equipment installed in this Contract.

(b) All surfaces to be painted shall be dry, clean, free from dust, dirt, grease, frost, rust, loose crystals or extraneous matter, tool and machine marks. Feather out edges of scratch marks to make patch inconspicuous.

(c) Apply one or more coats of paint until the damaged surface has been restored to original finish condition. Do not apply succeeding coats until preceding coat is dry and hard. Sand lightly between coats with No. 00 sandpaper.

(d) Be responsible for obtaining the necessary touch-up paint of the original type and quality from the equipment manufacturer.

E34.3.21 Sleeves and Openings

(a) Provide sleeves and openings for exposed conduits, busways, and wireways, where they pass through walls or floors conforming to relevant fire codes where applicable.

(b) Sleeves for individual conduits shall be RPVC.

(c) Pack or fill sleeves and openings after the completed work is in place. Filling shall provide a waterproof seal to prevent leakage of water or other liquids through the sleeve or opening.

(d) Sleeves and openings shall not displace reinforcing steel, and shall receive approval of the Contract Administrator prior to placement.

E34.3.22 Cutting and Patching

(a) Provide all drilling, cutting, fitting and patching necessary for the running and securing of conduits, wireways, and other electrical equipment.

(b) Provide supports necessary for same.

(c) Provide bracing and anchorage of work subject to Contract Administrator's approval.

(d) Do not cut the structural members or the fireproofing without the written consent of the Contract Administrator.

(e) Caulk and flash all conduits passing through walls, roofs or other surfaces exposed to weather or as indicated on the Drawings to prevent the passage of water, air and sewer gases.

E34.3.23 Hangers and Supports

(a) Provide hangers, angles, channels, and other supports necessitated by field conditions to install all items of electrical equipment. Design of supports and methods of fastening to building structures shall be subject to the Contract Administrator's approval.

(b) All local motor control devices are to be grouped and mounted on a free-standing frame of galvanized steel unistrut construction easily accessible and as close to the motor as possible.

(c) Provide weight-distribution facilities, where required, so as not to exceed the load-bearing capacities of floors or walls that bear the weight of, or support, electrical items.

(d) Paint all exposed parts of hangers and supports with an anti rust inhibiting primer except galvanized components.

(e) Equipment shall not be held in place by its own weight. Provide base anchor fasteners in each case.

E34.3.24 Protection of Equipment

(a) Protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps.

(b) Fixtures, materials, equipment, or devices damaged prior to final acceptance of the work shall be restored to their original condition or replaced by the Contractor.

E34.3.25 Testing of Electrical Systems - General

(a) Prior to acceptance, all electrical equipment, materials and systems installed shall be subject to an inspection and applicable performance tests supervised by the Contract Administrator to ensure that the operation of the system and components satisfy the requirements of the Specifications.

(b) Ensure that the system and its components are ready prior to the inspection and test for acceptance.

(c) All testing shall be conducted by fully qualified personnel only. Tests requiring initial power energization of a system shall not be made without notification of the Contract Administrator. Tests, checks and the like carried out by or on behalf of the Contractor shall be documented and certified at no additional cost to The City. Submit six copies of the test certificates to the Contract Administrator.

(d) Carefully check wiring for each system and part of a system to ensure that the system will function properly as indicated by wiring and schematic diagrams and description of operation.

(e) Manually operate alarms and control devices to check whether their operation during normal and abnormal operating conditions causes the proper effect.

(f) In addition to tests on purely electrical systems, supply the necessary labour and equipment for operational tests required where other electrical services are involved and make final adjustments to the electrical controls.

(g) Perform tests on auxiliary or specialized systems with the assistance of the manufacturer's representative. Upon successful conclusion of the tests, obtain a certificate from the manufacturer stating that the system has been installed to their satisfaction and that it is in good working order.

(h) Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to values and settings as indicated.

E34.3.26 Conduit, Fastenings and Fittings

(a) Supply and install all conduits, fittings, supports, hangers and miscellaneous support materials and hardware required for the complete systems in accordance with the applicable codes and regulations as specified and as shown on the Drawings.

(b) Conduit shall be rigid P.V.C. Minimum size to be 12 mm.Rigid PVC (Unplasticized) conduit to CSA C22.2 No. 211.2-M1984.

(c) Liquid-tight flexible metal conduit for motor and equipment connections. Liquid-tight flexible metal conduit to CSA C22.2 No. 56-1977.

(d) The Drawings do not show every specific conduit run. All conduit shall be surface mounted or run in the slab unless otherwise indicated in the Specifications or shown on the Drawings. All devices shall be surface mounted type except as shown.

(e) Use two hole PVC straps to secure surface conduits. Use beam clamps to secure conduits to exposed steel work. Couplings, terminal adapters, female adapters shall be of the IPEX type or equal. PVC fittings shall be installed in all areas. Fish cord shall be polypropylene. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

(f) All conduits entering outlet boxes and devices that are located in walls subject to movement shall be terminated by means of liquid-tight flexible conduit, approximately 450 mm in length between the PVC conduit and the outlet box or device which is being supplied. All conduits, bus duct, wireways, etc., passing through or across expansion joints of the building shall be installed with the use of approved expansion fittings.

(g) Cut conduit ends square and ream to remove burrs and sharp edges. Ensure that conduits butt into couplings and other fittings.

(h) Bends and offsets shall have a minimum radius of curvature not less than the minimum bending radius of the cable to be installed.

(i) Temporarily plug all conduits terminating in cabinets and boxes where moisture and foreign matter may enter.

(j) Blow all conduits through with clean compressed air to clear all foreign matter and moisture prior to the installation of wires or cables.

(k) Install fish cord in all conduits.

(l) Group exposed conduits together wherever possible and run parallel to building lines, supported from structural members and protected by the flanges of the structural member where practical.

(m) Make no holes in building structural members for supporting conduits without the permission of the Contract Administrator.

(n) Securely fasten exposed conduits in place at regular intervals with hangers, supports or straps. Provide additional supports at each elbow and terminations at a box or cabinet.

(o) Use of perforated metal straps to support conduits is unacceptable.

(p) Install conduits at least 1 m clear of heaters. Do not bend conduits over sharp objects or improperly form.

(q) The maximum length of straight conduit run shall be 30 m between pull boxes or other terminations. This length shall be reduced by 10 m for each 90-degree bend or 5 m for each 45-degree bend or offset. Conduit runs shall not include more than the equivalent of two 90-degree bends between pull boxes except where indicated otherwise on the Drawings.

(r) Seal conduits passing through roof, with flashing and make weatherproof. Seal conduits passing through exterior walls, above or below grade, with waterproof sealing compound.

(s) Do not run conduits across openings, across floors, or along walls directly above or beneath an opening.

E34.3.27 Wire and Cable

(a) Supply and install all wiring, terminations, wire markers, cable tags, cable ties, splice fittings, insulating tapes, connectors and miscellaneous materials necessary to complete the wiring system.

(b) Install all wire according to the Drawings with a minimum size of #12 AWG unless indicated otherwise.

(c) Pull wire into ducts and conduits in accordance with the manufacturer's recommendations, using patented wire grips suitable for the type of wire or by using pulling eyes to be installed directly onto the conductors.

(d) Limit pulling tensions to those recommended by the manufacturer to avoid overstressing wire.

(e) Utilize adequate lubricant when pulling wires through ducts and conduits to minimize wear on cable jackets.

(f) No splices shall be permitted in cable or wiring runs without the written permission of the Contract Administrator, and shall only be permitted in junction boxes.

(g) Neutral conductors shall be identified. Paint or other means of colouring the insulation shall not be used.

(h) Unless otherwise specified, make all wiring taps, splices and terminations with identified compression screw type terminal blocks, securely fastened to avoid loosening under vibration or normal strain. Make connections for interior and exterior lighting circuits and 120 volt, 15 amp convenience receptacle circuits using screw-on or split-bolt connectors and insulating tape.

(i) Determine the exact length of cable required to avoid splices.

(j) Identify each conductor by specified markers at each termination indicating the circuit designation or wire number.

(k) Identify each cable by attaching a suitable marker, stamped or indelibly marked with the cable number, at each end of the cable and in all junction boxes and pull boxes.

E34.3.28 Wiring Accessories

(a) Provide cable grips for all vertical and catenary cable suspension installations to reduce cable tension at connectors or at cable bends.

E34.3.29 Testing of Wire and Cable

(a) Tests on cables in this voltage range shall be limited to insulation resistance measurements using a 500V megger for systems up to 350V and a 1000V megger for 351-600V systems.

(b) Record all test results in a log book and submit to the Contract Administrator for reference. Replace or repair all circuits which do not meet minimum requirements specified in the CEC, Table 24. Insulation resistance of the following circuits shall be measured:

(i) Power, lighting and motor feeders (with equipment disconnected): phase-to-phase,
(ii) Phase-to-neutral and phase-to-ground.
(iii) Control circuits: measure to ground only.

(c) Do not perform megger tests on control circuits containing transistorized or solid- state components.

(d) Where power factor correction equipment is installed, it may be necessary to disconnect the capacitors from the system prior to testing to avoid overvoltage.

E34.3.30 Wire and Box Connectors

(a) Remove insulation carefully from ends of conductors and:

(i) Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65-M1988.
(ii) Install fixture type connectors and tighten. Replace insulating cap.
(iii) Install crimp type connectors to the satisfaction of the Contract Administrator.
(iv) Install box connectors to CSA requirements.

E34.3.31 Outlet Boxes

(a) Install boxes to clear all building and mechanical services equipment. Where two or more devices are shown at one location, utilize multi-gang boxes. Provide all outlet boxes with covers as required.

(b) Size all boxes to accommodate the number of conduits, conductors and terminal blocks. Provide junction boxes with 20% spare terminal blocks.

(c) Securely fasten surface-mounted boxes to the building or mounting structure and support independently of the conduits entering the box.

(d) Install junction and pull boxes mounted on brick, concrete or block walls with 3 mm thick nylon washers between box and wall face.

(e) Mark location and size of all pull boxes on the record drawings.

E34.3.32 Receptacles

(a) Install all 15A receptacles with "U" ground slot up.

(b) Mount duplex receptacles vertically.

(c) Install receptacles in gang type outlet box when more than one receptacle is required in one location.

(d) Mount receptacles at height specified as indicated on the Electrical Drawings.

(e) The location of all outlets as shown on the electrical plans is approximately correct at the time of planning, but as these Drawings do not show all structural details, field measure work requiring accurate dimensions.

(f) The location of outlets shown on the Drawings may be changed by the Contract Administrator at no extra cost to The City, providing the distance does not exceed 3000 mm and the information is given before installation.

E34.3.33 Switches

(a) Install single throw switches with handle in "UP" position when switch is closed.

(b) Utilize gang type outlet box where more than one switch is required in one location.

(c) Mount toggle switches at height specified in E34.3.16.

(d) The location of all outlets as shown on the electrical plans is approximately correct at the time of planning, but as these Drawings do not show all structural details field, measure work requiring accurate dimensions.

E34.3.34 Cover Plates

(a) Install all cover plates prior to energization.

(b) Cover plates shall be straight and true.

(c) Install suitable common cover plates where wiring devices are grouped.

(d) Flush-mounted cover plates shall be flush with the wall.

(e) Do not use cover plates meant for flush-mounted outlet boxes on surface-mounted boxes.

E34.3.35 Disconnect Switches

(a) Install disconnect switches as per manufacturer's recommendations.

(b) Mount switches at 1400 mm above finished floor to the underside of the switch enclosure.

E34.3.36 Grounding

(a) Make all conductor joints, splices and connections with permanent type thermit welds or mechanical compression connectors utilizing hydraulic tools.

(b) Make ground connections to building steel or flat metallic surfaces with thermit welds. Locate connections where they will not be subject to mechanical damage and, where possible, be accessible for inspection.

(c) Protect grounding conductors or bus subject to mechanical damage by rigid steel conduit or steel guards which shall be effectively grounded at both ends to the ground conductor they are protecting, regardless of their length.

(d) Make connections to ground bus using mechanical clamp type connectors.

(e) Securely bond metal enclosures, motor frames, steel supports for starters, panels, switches, etc., which are not rigidly secured to and in contact with grounded structural steel of a building or conduit system, or which are subject to excessive vibration, to building steel or conduit system with stranded copper conductors.

(f) Install ground conductors passing through masonry walls, floors, and foundations, in 25 mm rigid PVC conduit sleeves. Where sleeves are installed in walls or floors below grade, seal the sleeves watertight after installation of ground conductor.

(g) Install grounding connections to typical equipment included in, but not necessarily limited to the following list: service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steelwork, distribution panels, outdoor lighting, telephone backboard.

(h) Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the Contract Administrator and inspection authority having jurisdiction.

(i) Test the grounding system efficacy for compliance with CSA Standard C22.1 and Supply Authority requirements. Verify that the ohmic resistance values specified therein are not exceeded. Record readings and submit signed report to Contract Administrator.

(j) Perform tests before energizing electrical system.

(k) Disconnect ground fault indicator during tests.

(l) Notify inspection and Power Supply Authorities that they may be present to witness testing and provide any assistance required by these Authorities for their own testing procedures.

(m) Perform tests in presence of the Contract Administrator.

(n) Submit written test results to the Contract Administrator.

E34.3.37 Dry Type Transformers

(a) Installation to C.E.C. Section 26-248.

(b) Remove shipping supports only after transformer is installed and just before putting into service.

(c) Loosen isolation pad bolts until no compression is visible.

(d) Make primary and secondary connections.

(e) Energize transformers immediately after installation is completed, where practicable.

E34.3.38 Panelboards

(a) Lock-on devices shall be provided for 10% of 15 to 30 A breakers. Lock-on devices shall also be provided for all emergency lighting receptacles.

(b) Make all field wiring connections and terminations. Connect loads to circuits as indicated and connect neutral conductors to common neutral bus with respective neutral identified.

(c) Provide nameplate for each panelboard engraved as directed.

(d) Provide complete circuit directory with typewritten legend showing location and load of each circuit.

(e) Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record all changes.

(f) Measure phase voltages at loads and adjust transformer taps to obtain, within 2%, rated voltage of equipment.

E34.3.39 Lighting Fixtures

(a) Supply and install where shown and as specified on the Drawing, all lighting fixtures c/w suspension devices, lamps and other attachments as specified or required to give the best appearance and mechanical installation.

(b) All fixtures which have minor scratches after installation shall be "touched up" with an approved enamel to match the fixture finish to the complete satisfaction of the Contract Administrator.

(c) Fixtures shall conform to building lines being parallel or perpendicular.

(d) Installation of all lighting equipment shall comply with the relevant section of the Canadian Electrical Code.

(e) At the completion of construction and acceptance of work, all lighting fixtures shall be clean, complete with all necessary accessories and provided with the required operating lamp(s).

E34.3.40 Exit Lights

(a) Install and wire as indicated on Drawings.

(b) Ensure exit light circuit breaker is locked in ON position.

E34.3.41 Electrical For Mechanical Equipment

(a) Supply and install of all wiring, conduit, and control devices related to the following mechanical systems:

(i) Electric motors for sewage pumps
(ii) Ventilation fan
(iii) Sump pump
(iv) Magnetic Flow Meter
(v) Differential Pressure Cell
(vi) Unit Heaters
(vii) City Supplied Alarm and Control Panel

(b) Supply and install all motor power wiring and conduit, all control wiring and conduit, all local and remote control devices, and all motor starters and contactors except where specified as components of "packaged" equipment.

E34.3.42 Field Instruments Installation

(a) Coordinate the work of this Section with the installation of the equipment specified in the relevant sections of E35 and E36 and shown on the Mechanical and Electrical Drawings.

(b) "Mounting" shall mean the positioning and fastening with proper brackets in the position required.

(c) All equipment shall be mounted in accordance with manufacturer's recommendations.

(d) Locations of all field instruments are subject to modification by the Contract Administrator who reserves the right to move any item up to 3 meters from the position shown, without change to the contract price, provided notice is given before the related work has commenced.

(e) Exact locations of all field instruments shall be site determined by the Contractor to the satisfaction of the Contract Administrator to ensure proper operation of the device.

(f) Employ any and all means of trade, skill, and workmanship to install all field instruments to the satisfaction of the Contract Administrator.

E34.3.43 Telephone System Installation

(a) Provide a system of conduits, boxes and jacks, for the telephone service in the building. Provide entrance conduit as required by the Telephone Utility. Provide a wall mounted telephone set as shown on the Drawings. Extend the necessary wiring to the RTU panel for future connection to telephone modem. Make all connections, and test system.

(b) Coordinate the installation, testing and commissioning of the following two (2) telephone lines with the Telephone Utility:

(i) Building telephone located in the BT RTU Panel.
(ii) RTU panel modem (future)

(c) Telephone set shall be surface mounted type.

(d) Supply and install all inside wiring and jacks as indicated on the Drawings, to the satisfaction of the Telephone Utility.

(e) Prior to locating all outlets and installing conduit systems, coordinate with the Telephone Utility engineering department to confirm all construction details.

(f) Each empty conduit shall contain a fish wire, to facilitate wiring installation.

(g) Install raceway system, wiring, distribution system, pullboxes, conduit sleeves and clamps for a complete system. Install 1200 mm x 1200 mm x 19 mm thick plywood backboard as indicated. Install grounding facilities and make corrections. Arrange for the installation of the Telephone Utility.

E34.3.44 Motor Control Centre

(a) Install embedded floor channels where applicable.

(b) Set and secure MCC's in place, rigid, plumb and square, on channel bases.

(c) Interconnect MCC cubicles with bus bar and wiring connectors supplied by manufacturer.

(d) Check factory-made connections for mechanical security, electrical continuity, and current phasing.

(e) Make grounding connections between equipment ground busses and building grounding system.

(f) After finishing work, remove foreign material, including dust, before energizing equipment.

(g) Make all power and control field wiring connections.

(h) Check overload trip unit settings against Drawings and motor nameplate data.

(i) Ensure moving and working parts are lubricated where required.

(j) Resistance measurement checks of bus shall be made phase-to-phase and phase-to-ground.

(k) Check current rating and/or settings of circuit breakers and fuses.

(l) Check overload relay current element rating against motor nameplate full load current rating and install correct size if found to be incorrect.

(m) Operate starters in sequence to provide satisfactory performance of motor control centre during 8 hour period.

E34.3.45 Motor and Control Wiring

(a) Provide electrical work pertaining to installation of equipment which is specified on the drawings and specification document required for fully functional and operational systems.

(b) Coordinate with mechanical shop drawings for electrical requirements. Where mechanical shop drawings differ in control or power requirements this shall be reported to the Contract Administrator.

(c) Coordinate overcurrent and overload protective devices with the nameplate ratings of the motors.

(d) Fill out a "MOTOR DATA SHEET" for each single phase and 3 phase motor and provide to Contract Administrator.

E34.3.46 Transient Voltage Surge Suppressor - Integral to MCC

(a) Install one primary suppressor within the switchboard at utility service entrance, according to manufacturer's recommendations.

(b) The suppressor shall be installed on the load side of the service entrance.

(c) Conductors between suppressor and point of attachment shall be kept short and straight.

(d) The suppressor's ground shall be bonded to the service entrance ground.

E34.3.47 Electric Unit Heaters

(a) Mount all unit heaters as indicated on the Drawings.

E34.4 Measurement and Payment

(a) Electrical will be measured on a Unit basis and paid for at the Contract Unit Price for “Electrical Work”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E35. MECHANICAL

E35.1 Description

E35.1.1 This specification shall cover the supply, fabrication and installation of mechanical piping, fittings, valves, pumps and associated items of Work.

E35.2 Materials

E35.2.1 Large Diameter Piping and Fittings

(a) Ductile iron pipe: to AWWA C151, thickness Class 52.

(b) Steel pipe: schedule 40, seamless black carbon steel to ASTM A53 Grade A, or ASTM A106 Grade A.

(c) Stainless Steel Pipe: schedule 40, ASTM A778 or ASTM A312

(d) Cast iron fittings: to ANSI/AWWA C110/A21.10, 1.0 Mpa working pressure complete with integrally cast flanges.

(e) Steel fittings: schedule 40, seamless carbon steel to ASTM A234 Grade WPB, dimensions to ANSI B16.9.

E35.2.2 Flanges and Adaptor Flanges

(a) Thread-on flanges for ductile iron pipe: to AWWA C115 or ASME B16.1.

(b) Weld on steel flanges for steel pipe: to ASTM A181 Grade 1, flat faced, slip-on style, 1.0 Mpa working pressure, dimensions to ANSI B16.5.

(c) Adaptor flanges: ductile-iron, Grade 65-45-12, conforming to the current ASTM Standard A536 Standard for Ductile-iron Castings. Bolt holes shall be drilled in accordance with AWWA C115 or ASME B16.1.

(d) Adaptor flanges to be Unit-Flange Series 400 for ductile iron pipe and Series 400-S for steel pipe or approved equal in accordance with B6.

(e) Clamping screws on adapter flanges shall be zinc-plated, heat treated steel with a minimum tensile strength of 28 Mpa.

E35.2.3 Small Diameter Piping, Fittings and Valves (75 millimetre diameter and less)

(a) PVC pipe: schedule 40 to ASTM D1784 Type 1, Grade 1and CSA B137.3.

(b) Socket type fittings: Schedule 40 PVC to ASTM D-2467.

(c) PVC valves: valve body, stem, ball and unions shall be made of PVC conforming to ASTM D-1784. Valve seats shall be Teflon.

(d) Solvent for PVC fittings: to ASTM D-2564.

(e) Sight tube: clear Schedule 40 PVC.

(f) Domestic cold water pipe: to ASTM B.88 Type 'L' third party certified hard copper tube.

(g) Domestic Cold Water Fittings: Wrought copper or cast brass, solder joint pressure fitting.

(h) Metal gate valves:

(i) Cast bronze body to ASYM B62

(ii) Solid wedge disk, rising stem c/w hand wheel. Direction of opening to be counter-clockwise and to be indicated on the hand wheel.

(iii) Rated for minimum 1.0 Mpa non-shock cold water service.

(iv) Treaded ends.

(v) Crane, Jenkins, Kennedy, Mueller, or approved equal in accordance with B6.

(i) Hose bibs: nickel plated brass wall faucet with Watts chrome plated vacuum breaker hose end. Crane Model 5046 or approved equal in accordance with B6.

E35.2.4 Modular Rubber Seals Around Pipes Through Concrete Walls

(a) Modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.

(b) Rubber links to be EPDM to ATSM D2000 M3 BA510 suitable for temperatures from -40 ºC to +121ºC. Color to be black.

(c) Modular seal pressure plates to be moulded of glass reinforced Nylon Polymer with the following properties:

(i) Izod Impact - Notched = 2.05ft-lb/in. per ASTM D-256

(ii) Flexural Strength @ Yield = 30,750 psi per ASTM D-790Flexural Modulus = 1,124,000 psi per ASTM D-790

(iii) Elongation Break = 11.07% per ASTM D-638

(iv) Specific Gravity = 1.38 per ASTM D-792

(d) Fasteners to be Type 316 Stainless Steel

(e) Acceptable product: Link-Seal or approved equal in accordance with B6.

E35.2.5 Water Meter and Backflow Preventor

(a) Water meter will be provided at no charge by City of Winnipeg, Water and Waste Department, Water Services Branch.

(b) Backflow preventor shall be Watts Model 909 QT.

E35.2.6 Large Diameter Pipe Supports and Hangers

(a) Pipe supports and hangers to be as shown on the Drawings.

E35.2.7 Nuts, Bolts and Fasteners

(a) Flange nuts and bolts: to ASTM A307 carbon steel sized to requirements of flange. Threads on bolts to extend past nut a maximum of 6 millimetres.

(b) Concrete anchor bolts shall be Type 316 Stainless Steel, Hilt Kick-Bolt or Raw Stud of the size shown on the Drawings. Embedment depth and size where not shown on the Drawings to be as required for load being carried or resisted.

E35.2.8 Gaskets

(a) Flange gaskets: full faced red rubber, 3millimetres in thickness.

(b) Rubber gaskets for adapter flanges shall conform to AWWA C111, Standard for Rubber-Gasket Joints for Cast Iron and Ductile-iron Pressure Pipe and Fittings.

E35.2.9 Flow Meter

(a) Rosemount Magnetic Flow Meter system comprising of a Rosemount Model 8705TSA080S1W0N0 Magnetic Flow Meter Flow Tube coupled with a Rosemount Model 8712DR12N0M4 Magnetic Flow Meter transmitter.

(b) Flow tube size to be as shown on the Drawings.

(c) The flow tube and transmitter shall be certified for use in a hazardous area by a recognized authority (FM/CSA Class 1, Div. 2 Approval) and the enclosures shall be Nema 4X rated.

(d) Magnetic flow meter system shall be powered by 120V ac, 60 Hz, and not consume more than 30 watts.

(e) The magnetic flow meter system shall be accurate to 0.5% of flow rate between 1 and 30ft/sec and be capable of reading flow rates as low as 0.04 ft/sec, and the accuracy includes the combined effects of linearity, hsyteresis, repeatability, and calibration uncertainty.

(f) Flow tube to be In-line with ANSI Class 150# carbon steel flanged ends and PTFE (Teflon) liner. Flow tube body to be welded steel design and must not rely on gaskets to fully protect the coils and electrode wiring.

(g) Flow tubes to be hydrostatically tested to 1.5 times their rated pressure.

(h) All local operator interfaces must be accessible without opening covers.

(i) The transition between the flow tube and the junction box must be potted to prevent process fluids from reaching the electronics or conduit in the event of a lining or electrode failure.

(j) Flow tube electrode material shall be 316L Stainless Steel.

(k) The electronics must be temperature compensated to maintain system accuracy of 0.5% or better across the stated temperature range.

(l) The field termination and electronics must be in separate, fully isolated compartments to prevent moisture or contamination to enter these compartments.

(m) The transmitter shall be a DC microprocessor based magnetic flow meter transmitter with HART based digital communications capabilities, 4-20 mA o/p and independently scalable pulse/frequency output.

(n) The transmitter shall be powered by 120vac, 60 Hz. and remote mounted (wall- mount or 2" pipe mounting configurations)

(o) The transmitter shall have an illuminated LCD indicating meter for indicating flow rates, flow totalizer, etc., and display 2 lines of a minimum of 20 characters.

(p) The transmitter shall have non-volatile memory for all data, including the totalizer.

(q) The remote mounted transmitter shall utilize readily available Beldon cables between the flow tube and the transmitter:

(i) Signal Cable (20 AWG) Belden 8762, part no: 08712-0061-0001

(ii) Coil Drive Cable (14 AWG) Belden 8720, part no: 08712-0060-0001

E35.2.10 Differential Pressure Cell

(a) Differential pressure cell will be provided by the City at no charge, complete with hardware and wiring as shown on the Mechanical Drawings.

E35.2.11 Gate Valves

(a) Bronze mounted, iron body with flanged ends

(b) Flanges to conform in dimension and drilling to ASME B16.1, Class 150.

(c) Outside rising stem, screw and yoke

(d) Bronze trimmed cast iron wedge

(e) Bronze stem

(f) Double O-ring stem seals

(g) Cast iron hand wheel with finger grips

(h) Direction of opening to be counter-clockwise and be clearly stamped or indicated with raised letters and arrow on the hand wheel.

(i) Manufacturer's nameplate shall be attached to the valve body with stainless steel fasteners.

(j) As manufactured by Crane, Jenkins, Kennedy, Mueller, Clow or approved equal in accordance with B6.

E35.2.12 Check Valves

(a) Ductile iron body with flanged ends and removable inspection cover manufactured and tested in accordance with AWWA C508.

(b) Flanges shall conform in dimension and drilling to ASME B16.1, Class 125.

(c) ASTM D2000-BG, Buna - N (NBR) sewage resistant rubber flap and Type 302 stainless steel disc accelerator.

(d) Manufacturer's nameplate shall be attached to the valve body with stainless steel fasteners.

(e) As manufactured by Val-Matic or approved equal in accordance with B6.

E35.2.13 Wastewater Pumping Equipment

(a) Wastewater pumps to be in accordance with E36.

E35.2.14 Sump Pump

(a) Cast Iron body with threaded discharge and lifting handle.

(b) Suitable in size for installation in sump pit shown on the Drawings.

(c) Rated capacity to meet or exceed 3 l/s. @ TDH of 8 m.

(d) 120VAC, single phase.

(e) Impellor: non-clog thermoplastic.

(f) Solids handling: 20 millimetres

(g) Mechanical seal: carbon rotary/ceramic stationary

(h) Required size of discharge: 50 millimetre diameter

(i) Complete with power cord and actuation float for automatic operation.

E35.2.15 Paint and Primer

(a) In accordance with Formula 1 indicated in E37.

E35.2.16 Submittals

(a) Submit shop drawings in accordance with E6 for the following:

(i) All large and small diameter valves.

(ii) Fabricated cast and steel fittings.

(iii) Water service backflow device.

(iv) Platform/support for backflow device and meter.

(v) Coupling for water supply.

(vi) Adjustable rubber seals through openings in walls.

(vii) Pipe supports and hangers.

E35.3 Construction Methods

E35.3.1 Large Diameter Piping, Fittings and Valves

(a) Install piping and equipment in accordance with the Drawings and Specifications, local authorities having jurisdictions and the National Building Code. In the case of conflicting requirements, most severe regulations will govern.

(b) Handle all piping, fittings and valves in a workmanlike manner. Piping, fittings and valves that are cracked, chipped, dented, dropped or otherwise damaged will not be accepted and shall be replaced by the Contractor at his own cost.

(c) Store all piping, fittings and valves in an enclosed shelter off the ground acceptable to Contract Administrator.

(d) Do not make revisions, alterations or substitutions to piping layouts, sizes, fittings and flanges as shown on the Drawings without written approval from the Contract Administrator.

(e) Ensure proper alignment of all equipment with particular reference to the pumps and associated drivers. All factory assembled rotating machinery shall be checked for alignment and adjustment made to manufacturer's limits. Check alignment of equipment after securing to foundations and grout sole plates or install concrete foundations after confirmation of alignment and review by the Contract Administrator.

(f) Install dimensioned pipes and fittings before fitting spool and filler pieces and join the entire piping system so that no stress or strain is created in the lines and associated equipment due to forcing pieces into position.

(g) Under no circumstances, will "pipe springing" be allowed.

(h) Install valves with stems and hand wheels in the vertical or horizontal position as shown on the Drawings.

(i) Ensure no debris, tools or other objects are left in piping, fittings and valves.

(j) Make all joints watertight and ensure gaskets are not pinched or folded inside joints.

(k) Flanges, branch connections, outlet and adapters shall be true and set at right angles to the axis pipes to ensure accurate fit. Connection shall not extend inside the pipe.

(l) Threaded flanges to be watertight to 1.0 Mpa.

(m) Temporary bracing and supports shall be provided to adequately support pipe, fittings and valves during installation. All permanent supports to be in place before temporary bracing and supports are removed. No piping to be supported by any item of equipment.

(n) Construct concrete foundation bases and adjustable supports required for piping, fittings and valves as shown on the Drawings.

(o) Correct discrepancies, irregularities, defects and damage to the piping, valves and equipment attributable to faulty or incorrect installation at own expense as directed by the Contract Administrator.

(p) Provide certificates where required that work installed conforms to requirements of authorities having jurisdiction. All changes and alterations required by an authorized inspector of any authority having jurisdiction shall be carried out at the Contractor's expense.

(q) Test water-tightness of entire piping system by running both pumps at full capacity. Correct leaks and other deficiencies as required and directed by the Contract Administrator.

E35.3.2 Welded Steel Pipe and Fittings

(a) Welding shall conform to CSA Standard W.59. Fabricator shall be fully approved by the Canadian Welding Bureau, in conformance with CSA Standard W.47.1. Welding shall be done by currently licensed welders only.

(b) Join pipe and fitting sections together using full penetration butt welds.

(c) Flanges to be fillet welded to pipe ends inside and outside with minimum 6 millimetre throat thickness.

(d) Welds to be watertight to pressure of 1.0 Mpa.

E35.3.3 Small Diameter Piping, Fittings and Valves

(a) Install small diameter PVC pipe, fittings and valves in accordance with the manufacturer’s instructions and in general conformity with ASTM D-2855.

(b) Field locate all runs to accommodate other piping, ventilation, wiring, etc. Pipe location shown on drawings is for reference only. Obtain approval from Contract Administrator before installing pipe.

(c) Use an approved primer before applying solvent cement to PVC fittings and pipe. Do not join pipe and fittings at temperatures below 10 degrees Celsius. Do not use cement that has gelled in the container or applicator.

(d) Install copper water pipe in accordance with manufacturer’s instructions. Clean and roughen outside of pipe ends and inside of fittings with emery cloth prior to soldering. All changes in direction to be made with fittings, pipe bending is not acceptable.

(e) Solder shall be lead free consisting of tin, copper and silver (Silvabrite 100 or equal).

(f) Valves shall be installed with stems upright or horizontal far enough away from walls or other objects that operation of the handwheel is unobstructed.

(g) Install dielectric insulating unions between all pipes or apparatus constructed of dis-similar metals. Use brass nipples at flush valves.

(h) Use a minimum of three layers of teflon tape around threaded fitting ends.

(i) Test backflow preventors in accordance with manufacturer's recommendations, Contract Administrator’s instructions or as required by provincial/ municipal authorities.

(j) Test water-tightness of sump pump discharge piping and sight tube piping. Correct any leaks as required and as directed by the Contract Administrator.

(k) Flush out piping systems before installation of equipment and fixtures to ensure foreign material in piping is removed.

(l) Pressure test water service piping systems in the presence of the Contract Administrator with water to 690 kPa (100 psig) at the highest point of system. Maintain pressure without loss for 4 hours. Correct deficiencies as directed by the Contract Administrator at own cost.

(m) Provide required adapters and connect water supply to fittings on existing wastewater pumps.

(n) Provide and install a suitable aluminum support and platform approved by the Contract Administrator to hold the backflow preventor and water meter. Secure meter and backflow preventor to platform with removable stainless steel fasteners.

(o) Arrange with City of Winnipeg, Water and Waste Department, Water Services Branch to install water meter on platform.

E35.3.4 Wastewater Pumping Equipment Start-Up and Field Testing

(a) Install the wastewater pumping equipment in accordance with manufacturer's instructions.

(b) Do not start-up and operate wastewater pumping equipment without approval from and in the presence of the Contract Administrator.

(c) Arrange with the wastewater pumping equipment Supplier to provide a qualified representative to inspect the installation.

(d) Provide the Contract Administrator at least one-week notice of the proposed schedule for wastewater pumping equipment start-up.

(e) Be present during start-up and field testing of the wastewater pumping equipment and provide assistance if required.

(f) The object of the field tests is to confirm the pumping equipment performs as specified and operates satisfactorily.

(g) Correct deficiencies with the wastewater pumping equipment installation as identified by the pumping equipment Supplier or Contract Administrator during the inspection prior to start up or after start up.

E35.3.5 Flow meter

(a) Install the flow meter, flow transmitter and interconnecting wiring between flow meter and flow transmitter in accordance with the manufacturer's instructions. City of Winnipeg staff will be responsible to complete the electrical connections to the flow meter. The manufacturer's installation instructions will be provided to the Contractor before work begins.

E35.3.6 Differential Pressure Cell

(a) Differential pressure cell will be installed by City of Winnipeg staff.

E35.3.7 Contract Drawings

(a) The Drawings for mechanical work are diagrammatic, performance drawings intended to convey the scope of work and indicate general arrangement and approximate location of apparatus, fixtures and pipe runs. The Drawings do not show all Architectural and Structural details.

(b) Do not scale Drawings. Obtain information involving accurate dimensions from site measurement.

(c) Make, at no additional cost, any changes or additions to materials and equipment necessary to accommodate structural conditions and components.

(d) Alter, at no additional cost, the locations of materials and/or equipment as directed by the Contract Administrator that do not necessitate additional material.

E35.3.8 Temporary Services

(a) Do not use any of the permanent systems in the pumping station during construction unless specific written approval is obtained from the Contract Administrator.

E35.3.9 Coordination

(a) Coordinate work with City Forces to avoid conflict.

E35.3.10 Cleanup

(a) Keep work area neat and cleanup on a regular basis to keep dust and dirt accumulations to a minimum

(b) Remove unneeded tools, equipment and materials from work area.

E35.3.11 Painting

(a) Prime and paint pipe, pumping equipment, valves and fittings after the installations are complete in accordance with E37. Provide the Contract Administrator with color samples to chose from prior to any painting being done.

E35.3.12 Cutting and Patching

(a) Cutting of openings in walls, slab and floors not shown on the Drawings or Shop Drawings shall be approved by the Contract Administrator. The opening size shall be kept to the minimum required. Patching shall be to the original or specified conditions, materials and finish.

E35.4 Measurement and Payment

(a) Supply and installation of mechanical work will be measured on a Unit basis and paid for at the Contract Unit Price for “Mechanical Work”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this Specification.

E36. WASTEWATER SEWAGE PUMPING EQUIPMENT

E36.1 Description

(a) This specification covers the supply and installation of wastewater pumping equipment.

E36.2 General

(a) Three (3) identical wastewater sewage pumping units are required for the Dugald Road Wastewater Pumping Station. Two (2) pumps will be installed in the new pumping station and one (1) pump will be a spare.

(b) The pumping units will be used to pump raw sewage having a temperature range of 0º to 30ºC and will operate under flooded suction conditions.

(c) Each pumping unit shall consist of a single stage, non-clogging, centrifugal flow pump with vertical mounted motor joined with a flexible coupling suitable for a dry pit installation.

(d) Durable metal nameplates shall be securely attached to each pump and motor supplied. Pump nameplates shall indicate the serial number, capacity, head, rpm, and other pertinent data. Motor nameplates shall indicate the serial number, voltage, phase, hertz, rpm, horsepower, service factor, Nema Design, insulation class and any other pertinent data.

(e) Pumps (3 required)

(i) Rated Capacity - each pump must meet or exceed the shown operating point: 63 L/s (1000 USgpm) @ 9.8m (32')

(ii)	(includes static head)	Head
(iii)	Rotation (viewed from above):	CW
(iv)	Type of impeller:	non-clog
(v)	Size of sphere pump impeller shall pass:	75mm dia.
(vi)	Required size of Suction:	254mm minimum dia.
(vii)	Required size of Discharge:	152mm minimum dia.
(viii)	Net Positive Suction Head Available:	15.6m (31.4) maximum

(f) Motors (2 required)

(i)	Maximum Horsepower:	15 HP
(ii)	Power Supply:	600 Volt AC, 3PH, 4W
(iii)	Speed:	1200 rpm
(iv)	Motor Service Factor:	1.15
(v)	Motor Efficiency @ : Full Load:	
	Percent of Full Load Amps at	83% min.
(vi)	Given Operating Point:	90% max.
(vii)	Motor Speed Torque Characteristics:	Nema Design B
(viii)	Starts Per Hour Capability:	6 maximum
(ix)	CSA Specification Conformance:	C 22.2 No. 100

E36.3 Shop Drawings

(a) Submit shop drawings to the Contract Administrator for all pumping equipment to be supplied and receive a release for construction from the Contract Administrator before equipment is produced for this Contract.

(b) At the time of submission inform the Contract Administrator in writing of any deviation in the shop drawings from the requirements of the Contract documents.

(c) Submit 5 prints on a sheet size appropriate for item and information being depicted or an electronic file in a format acceptable to the Contract Administrator.

(d) Show following information in the lower right hand corner of each shop drawing
  (i) Name of pumping station.
  (ii) City's Bid Opportunity Number.
  (iii) Manufacturer's name and description or model number of the item.
  (iv) Serial number(s) of equipment.
  (v) Date (to be revised per resubmission)

(e) The Contract Administrator will review the shop drawings and will release them for production with reasonable promptness so as to cause no delays. The review is only for conformance with the design concept of the project and with the information given in the specifications. The Contract Administrator's review of a separate item shall not indicate approval of an assembly in which the item functions.

(f) Make any corrections required by the Contract Administrator and resubmit the specified number of corrected copies of each shop drawing. Direct specific attention in writing or on resubmitted shop drawings for revisions other than the corrections requested by the Contract Administrator on previous submissions.

(g) By approving and submitting shop drawings, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, or will do so, and that he has checked and coordinated each shop drawing and sample with the requirements of the Work and of the Specifications.

E36.4 Operating and Maintenance Manuals

(a) Provide the Contract Administrator with five (5) bound copies of the manufacturer's technical literature for each component of the pumping equipment supplied detailing correct installation procedure and recommended operating and maintenance schedule, grades of lubricants required and assembly/disassembly instructions.

E36.5 Design, Workmanship and Construction

(a) General

(i) All unspecified materials shall be selected specifically for their suitability considering their duty. Castings shall be free from flaws and imperfections and machined surfaces finished true.

(ii) The inside and outside corners and edges of all castings shall be rounded off. Nuts and bolts shall have approved means to prevent them from becoming loose (pins, spring or friction washered fasteners, or mastic compound). No patching, plugging, shimming or other means of overcoming defects, discrepancies or errors shall be used without the written permission of the Contract Administrator.

(iii) All rotating components shall be statically and dynamically balanced as an assembled unit.

(b) Casings

(i) Pump casings shall be cast iron conforming to ASTM Specification A 48, for Gray Iron Castings, Class 30 or approved equal in accordance with B6.

(ii) The pump casing shall be of the centrifugal volute type of ample thickness and rigidity to withstand stresses due to hydraulic forces, weight of piping, erection loads, operating and testing.

(iii) The casings shall be so proportioned that the change in energy of the sewage from the kinetic form as it leaves the impeller, to the pressure form as it leaves the casing will take place gradually without eddy formation or shock. It shall be so designed that radial forces of the impeller shaft and bearings shall be balanced. Inside water passages shall be smooth and free from any projections.

(iv) The front head shall permit equal distribution of sewage to all parts of the impeller without the use of stationary guides or vanes on the suction side of the impeller.

(v) The casing shall be designed to permit the removal of the rotating assembly without disturbing the suction and discharge piping.

(vi) The volute shall be equipped with a hand hole to permit access to the inside for cleaning and unclogging of the volute. A tapped 10mm NPT hole shall be provided on the top of the volute to allow trapped air within the volute to be bled off. The tapped hole shall be provided with a suitable length of brass pipe and a shut off ball valve.

(vii) The fully assembled casing shall be shop tested and certified to successfully withstand a hydrostatic test pressure of not less than 1.5 times the shut-off head of the largest impeller size as shown by the characteristic curve.

(viii) The casing shall be equipped with a lifting ring capable of lifting the back head/impeller sub-unit or the entire pumping unit.

(c) Back head and Stuffing Box

(i) The back head shall be a separate piece from the volute casing and of cast iron conforming to ASTM Specification A 48, for Gray Iron Castings, Class 30 or approved equal in accordance with B6.

(ii) The back head shall be designed to rigidly support the bearing frame and be a self-centering and self-indexing fit with the volute casing to ensure proper alignment with a minimum of two large openings opposite each other adjacent to the stuffing box to allow access for maintenance.

(iii) Provision shall be made on the back head for external axial adjustment of the rotating element to maintain proper clearance between the impeller and front head wearing rings.

(iv) The stuffing box shall be integral with the back head and suitable for the use of a double mechanical seal and provided with a bolt down two piece split gland plate.

(v) Tapped 10mm NPT inlet and vent holes complete with suitable lengths of brass pipe and shut-off ball valves shall be provided on the stuffing box for seal water inlet and outlet.

(vi) The stuffing box shall be provided with a tapped drain hole.

(d) Bearing Frame

(i) Bearing frame shall be cast iron conforming to ASTM Specification A 48, for Gray Iron Castings, Class 30 or approved equal in accordance with B6 machined for accurate and permanent bearing alignment completely enclosing the shaft between the bearings.

(ii) The bearing frame shall be designed to rigidly support the motor adapter frame and be a self-centering and self-indexing fit with the back head to ensure proper alignment.

(iii) Provide lip type grease seals in contact with the shaft complete with grease fittings for bearing lubrication.

(e) Motor Adapter Frame

(i) Each pump shall be coupled to its driving motor by an adaptor frame.

(ii) Frames shall be fabricated from cast iron conforming to ASTM Standard A48, for Gray Iron Castings, Class 30 or approved equal in accordance with B6 of sufficient size, strength and rigidity to support the motor and prevent twisting and vibration.

(iii) The motor adapter frame shall be self-centering and self-indexing fit with the bearing frame to ensure proper alignment.

(f) Suction and Discharge

(i) Suction and discharge shall be flanged, faced and drilled to conform to ASME Specification B 16.1 (Class 125).

(ii) Pumps shall be equipped with a 90º suction elbow with a hand hole to permit access to the suction side of the impeller for cleaning and inspection. Suction elbows may be of the increasing type in order to meet the required suction size.

(iii) Gauge connections, tapped for 10mm NPT threaded pipe, shall be provided on each suction and discharge nozzle located close to flanges. Tapped holes shall be provided with suitable removable plugs.

(iv) The suction and discharge shall be orientated horizontally opposite each other preferably on the centreline of the pump.

(g) Impeller

(i) The impeller shall be fabricated from cast iron conforming to ASTM Specification A 48, for Gray Iron Castings, Class 30 or approved equal in accordance with B6. The cast iron shall contain not less than 3 percent nickel.

(ii) The impeller shall be of the non-clog enclosed channel type. The impeller shall be cast in one piece and shall be balanced both statically and dynamically. If the impeller supplied has been trimmed from a larger impeller, it shall be trimmed over its full height, no lip or protrusion shall be left around the bottom edge. Trimmed impellers shall be balanced after trimming. The impeller shall be machined and polished to a smooth finish.

(iii) The impeller shall be designed to ensure smooth operation without cavitation or vibration and shall be keyed securely to the tapered shaft and held in place by an impeller nut and stainless steel set screw. The impeller nut shall be dome shaped with a smooth face and blend into the hub so as not to allow any stringy material to accumulate around the nut. Hex shaped nuts shall not be used. The assembly of the impeller and shaft shall be so constructed and the parts so interlocked that the impeller cannot become loosened by torque resulting from rotation.

(h) Wear Rings

(i) Removable wear rings of the axial or radial type shall be provided for the front head and impeller. Wear rings shall be fabricated from stainless steel conforming to ASTM Standard A296, for Corrosion-Resistant Iron Chromium, Iron-Chromium-Nickel, and Nickel-Base Alloy Castings for General Application, Grade CA-15 or approved equal in accordance with B6.

(ii) The rings shall be machined for a close fit to minimize the leakage of sewage from the discharge to the suction. The rings shall be attached in such a way as to allow for ready adjustment or replacement and to prevent loosening under normal operation or under reverse pump rotation. The impeller ring hardness shall be not less than 300 Brinell and shall exceed the front head ring hardness by not less than 50 Brinell.

(i) Shaft Assembly

(i) The shaft assembly shall be fabricated from steel conforming to ASTM A108, Grade 1141 or approved equal in accordance with B6.

(ii) The shaft shall be of sufficient diameter to assure rigid support of the impeller and to transmit loads without slip, vibration or undue deflection at all operating speeds and loads.

(iii) The shaft shall be accurately along its entire length and keyways shall be provided at both ends.

(iv) A replaceable shaft sleeve fabricated from stainless steel conforming to ASTM A296, Grade CA-15 or approved equal in accordance with B6 shall be provided where the shaft passes through the stuffing box. The hardness shall not be less than 350 Brinell.

(v) Shaft sleeve shall be fitted and securely fastened in place after grinding and sealed to prevent leakage between the sleeve and shaft.

(vi) The shaft sleeve shall extend no less than 2mm above the top of the gland cover.

(j) Bearings

(i) Bearings shall be of the heavy duty anti-friction type suitable for oil or grease lubrication. Radial bearings shall be of the self-aligning plain roller or ball type and thrust bearings shall be of the tapered roller or angular contact type. All bearings shall be amply proportioned for all possible loads without undue heating and shall be rigidly supported so as to counteract any possible tendency towards vibration. Duplex bearings, if used, shall be ground and matched.

(ii) Lubrication shall be adapted to the operation of the units without full-time attendance.

(iii) The bearings shall be designed for a B-10 life of not less than 100,000 hours in accordance with AFBMA.

(k) Mechanical Seals

(i) The pumps shall be equipped with double mechanical seals. The sealing faces shall be either solid tungsten carbide to solid tungsten carbide or solid silicon carbide to solid silicon carbide. Secondary seal faces shall be of the same material as primary seal surfaces. Seals shall be as manufactured by John Crane, Durametallic or approved equal in accordance with B6.

(ii) Seals shall be pressurized and lubricated by domestic water.

(l) Pump Support

(i) Pumps shall be provided with a rigid four legged stand or the 90° suction elbow shall have an integrally cast base support to firmly support the entire weight of the pump. The stand or base shall be suitable for mounting to the existing concrete floor or on a concrete base using anchor bolts.

(m) Motors

(i) Each pump shall be driven by a vertical shaft, squirrel cage, totally enclosed fan cooled, induction motor. Motors shall conform to CSA Specification C22.2 No. 100 and all other CSA Specifications referenced therein.

(ii) Motors shall be suitable for full voltage or reduced voltage starting and be of a High Efficiency design.

(iii) Each motor shall be able to operate, without damage, at full load with voltages from 10% below to 10% above 575 volts. Motor horsepower shall not be less than 5% in excess of the maximum power requirement of the pump at any point on the pump characteristic curve. This rating shall be exclusive of the motor service factor.

(iv) Each motor will be subject to a maximum of six (6) start/stop cycles per hour and the stator winding insulation suitable for such operation.

(v) In no case shall stator winding insulation be less than Class F.

(vi) Each motor shall be equipped with heavy duty grease-lubricated and anti-friction bearings with an AFBMA B10 rating of 100,000 hours.

(vii) Each motor shall have a maximum noise level of 85 dBa at 1.2m distance.

(viii) Acceptable motor manufacturers: Westinghouse, General Electric, Toshiba, Baldor, U.S. Electric, TECO or approved equal in accordance with B6.

(n) Flexible Coupling

(i) The pump shaft shall be coupled to the motor shaft with a flexible coupling such as Atraflex or approved equal in accordance with B6.

(ii) The coupling shall be sized and rated for use with the motor size provided.

(o) Coupling Guards

(i) Provide flexible, removable, U-shaped, minimum 1.6mm thick galvanized steel mesh coupling guards around each flexible coupling.

(ii) Construct and install coupling guards to OSHA standards.

(p) Painting

(i) All exterior metal surfaces, except finished and machined surfaces, shall be given two undercoats of a rust inhibitive primer and one coat of an approved enamel. Nameplates shall not be painted over.

(ii) Colour to be dark blue as approved by Contract Administrator.

(q) Pumping Equipment Test

(i) Conduct pump tests in accordance with Hydraulic Institute Standards - Centrifugal Pumps Test Code. All definitions for the purpose of testing shall be as set forth by Hydraulic Institute Standards - Centrifugal Pumps Ratings.

(ii) Conduct motor tests in accordance with CSA 22.2 No. 100, EEMAC, MG-2. each motor shall be tested for:

(i) Running current

(ii) Locked rotor current

(iii) Hi-pot test

(iv) Winding resistance

(r) Shop Tests

(i) Test each pump in the manufacturer's shops over the range of operation from shut-off to run-out.

(ii) Provide a certified test curve in duplicate showing the head, capacity, pump efficiency and power for each pump to the Contract Administrator for review prior to shipping equipment.

(iii) Test curves to be signed by the pump manufacturer’s official responsible for the test.

(iv) Final payment for the pumping equipment will be made only after the Contract Administrator has received the certified test curve for each pump supplied.

(s) Field Tests

(i) Field tests will be performed on each pumping unit as soon as possible after the Contractor has inspected the installation. Field tests will be to determine and check for the following.

(i) Direction of rotation.
(ii) Capacity.
(iii) Noise (bearing, mechanical seal, cavitation, other).
(iv) Vibration
(v) Electrical energy supplied to the motors from motor control centre.

(ii) The liquid pumped during the field test will be raw sewage with a density taken to be 1.00 kilogram per litre.

(iii) If the field pump tests indicates the equipment supplied does not meet the specified requirements, the Contractor shall promptly correct the problem at his expense to the Contract Administrator's satisfaction.

(iv) If the Contractor is not satisfied with the procedure of the tests or the City's interpretation of the results thereof, the Contractor may have the tests repeated, or their interpretation referred to a referee acceptable to both the City and himself. The cost of the services of such referee shall be borne by the City if the referee rules that the tests as reported by the City were to the detriment of the Contractor, but if otherwise, the Contractor shall pay the cost of the services of the referee and of repeating the tests. The decision of the referee shall be final and binding both on the City and the Contractor.

(v) One of the installed pumps shall be removed after field testing and the third pump installed in its' place and field tested as well. The previously installed pump will then become the spare pump and need not be re-installed.

E36.6 Spare Parts

(a) Provide the following spare parts for the pumping equipment.
(i) 3 sets of wear rings.
(ii) 3 mechanical seals.
(iii) 2 impellers (full size – not trimmed).
(iv) 3 volute gaskets.

(b) Spare parts shall be properly packaged to resist damage and the package shall be clearly identified as to its contents.

(c) Spare parts shall be identical to those supplied in the pumping equipment.

E36.7 Tools and Accessories

(a) Provide special tools or accessories required for maintenance, adjustment, assembly or disassembly of the equipment supplied.

E36.8 Installation of Pumping Equipment

(a) Install pumping equipment in accordance with pump manufacturer's instructions.

(b) Review installation with pumping equipment supplier prior to installation to ensure full understanding of the installation requirements.

(c) Do not rely on construction drawings for installation details. Construction drawings are to be used for general arrangement dimensions and details only.

E36.9 Initial Start-up Inspection

(a) Provide the services of a qualified technical representative to be present at the initial start-up of each pumping unit supplied under this Contract to perform the following.
(i) Inspect the pumping equipment to ensure it has been properly installed in accordance with the manufacturer's instructions.
(ii) Conduct and document amp draw, rotation and speed tests.
(iii) Check for unusual vibration or noises.

(iv) Instruct City personnel in the operation and maintenance of the equipment if required.

(b) Obtain and provide Contract Administrator with recorded documentation of start-up inspection from pump supplier's representative for each pump and motor as well as a certificate or letter indicating the pumping equipment has been acceptably installed.

E36.10 Correcting Deficiencies With Pumping Equipment

(a) Promptly correct any deficiencies with the installation of the pumping equipment identified by the pump supplier to the Contract Administrator's satisfaction.

(b) Correct minor deficiencies with pumping equipment requiring less than a day to repair on-site.

(c) Remove pumping equipment that will take longer than one day to repair and install spare pumping equipment.

(d) Deliver pumping equipment to supplier's shop or other designated location for repair and promptly return repaired pumping equipment to the pumping station for installation and field testing.

(e) Repeat initial start-up inspection and field testing of repaired pumping equipment in presence of pumping equipment supplier and Contract Administrator.

E36.11 Measurement and Payment

(a) All costs associated with the supply, delivery, installation, initial start-up inspection and field testing of pumping equipment as specified shall be included in "Mechanical Work".

(b) All costs associated with the supply of shop drawings, spare tools, accessories and Operating and Maintenance Manuals as specified shall be included in "Mechanical Work".

(c) Correction of pumping equipment deficiencies as specified will be at Contractor's own expense.

E37. PAINTING

E37.1 Description

E37.1.1 General

(a) This specification shall cover supply and application of paint and associated work for the items included.

E37.2 Materials

E37.2.1 Paint

(a) Paint materials for each coating formula to be products of a single manufacturer.

(b) Colour schedule will be determined by the Contract Administrator from a selection of the manufacturer's full range of colours.

E37.2.2 Paint Finishes

(a) Formula 1 (Alkyd): for shop primed and unprimed ferrous metal surfaces:

(i) Touch-up shop primer (if used) with primer provided by the manufacturer.

(ii) One coat marine alykd metal primer CGSB-1-GP-48M.

(iii) Two coats semi-gloss enamel CAN/CGSB-1.57.

(iv) Acceptable products: Pratt and Lambert, Benjamin Moore, Glidden or Northern Paint.

(v) Provide color samples to the Contract Administrator for approval before application.

(vi) Paint and primer shall be from the same manufacturer.

(b) Formula 2: for concrete, walls and ceilings:

(i) One coat latex primer-sealer CAN/CGSB-1.119.

(ii) Two coats semi-gloss enamel CAN/CGSB-1.57.

(iii) Acceptable products: Pratt and Lambert, Benjamin Moore, Glidden or Northern Paint.

(iv) Paint and primer to be white.

(v) Paint and primer shall be from the same manufacturer.

E37.3 Construction Methods

E37.3.1 Standard of Acceptance

(a) Walls: No defects visible from a distance of 1000 millimetres at 90 degrees to surface when viewed using final lighting source.

(b) Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

(c) Piping, valves and pumping equipment: N visible defects from a distance of 1000 millimetres at 90 degrees to surface when viewed using final lighting source.

(d) Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

E37.3.2 Delivery, Storage and Handling

(a) Deliver and store materials in original containers, sealed with labels intact.

(b) Indicate on containers or wrappings:

(i) Manufacturer’s name and address.

(ii) Type of paint.

(iii) Compliance with applicable standard.

(iv) Colour number in accordance with colour schedule provided by Contract Administrator.

(c) Observe manufacturer’s recommendations for storage and handling.

E37.3.3 Safety Requirements

(a) Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

E37.3.4 Extra Materials

(a) Submit one 4-litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.

(b) Deliver to The City and store as directed.

E37.3.5 Protection

(a) Cover or mask floors, walls, and equipment adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.

(b) Protect items that are permanently attached such as Fire Labels on doors, frames, and name plates on equipment.

(c) Protect factory finished products and equipment.

E37.3.6 Cleaning and Surface Preparation

(a) Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

(i) Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

(ii) Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

(iii) Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

(iv) Allow surfaces to drain completely and allow to dry thoroughly.

(b) Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

(c) Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

(d) Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

(e) Apply wood filler to nail holes and cracks.

(f) Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted.

(g) Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

E37.3.7 Application

(a) Apply primer and paint using spray, roller or brush methods in accordance with the paint manufacturer's instructions. Surfaces to be painted shall be thoroughly cleaned of dirt, concrete, grease, weld slag and foreign matter before application. Sufficient drop clothes, shields or other protection shall be provided to protect adjacent piping, equipment, walls and floors from drips or splatters.

(b) Do not paint over galvanized metal, aluminium, stainless steel, brass or bronze, rubber, plated surfaces, machined surfaces, hangers and nameplates.

(c) Ventilate area of work by use of approved portable supply and exhaust fans.

(d) Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.

(e) Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.

(f) Apply paint only when surface to be painted is dry, properly cured, and adequately prepared.

(g) Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

(h) Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

(i) Sand and dust between each coat to remove visible defects.

(j) Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

(k) Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

(l) Paint both sides and edges of backboards for electrical equipment before installation. Leave equipment in original finish except for touch-up as required.

E37.3.8 Cleanup

(a) Clean and reinstall all hardware items that were removed before undertaken painting operations.

(b) Remove over-spray, paint splatter and spilled paint from exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using water or compatible solvent.

E37.4 Measurement and Payment

(a) Supply and application of paint will be included in the price for "Wastewater Pumping Station".

E38. WORK BY OTHERS

E38.1 Work by others on or near the Site will include but not necessarily be limited to:

(a) Manitoba Hydro installing the electrical service to the proposed pump station;

(b) MTS installing the phone service to the proposed pump station; and

(c) Contractor installing the wastewater sewer pipe on the north and south sides of Dugald Road as part of the Dugald Secondary Sewer Renewal – Phase 3 project to be done concurrently by others. Contractor installing the wastewater pipe will also install the 375mm diameter inlet pipe to the inlet wall piece constructed as part of the Dugald Pumping Station.

E39. COOPERATION WITH OTHERS

E39.1 Further to GC:6.25, the Contractor's attention is directed to the fact that other Contractors, the personnel of other utilities and staff of the City of Winnipeg will be working in the areas on or adjoining the site. The activities of these agencies may coincide with the Contractor's execution of the Work, and it will be the Contractor's responsibility to cooperate to the fullest extent with personnel working in the area, and such cooperation is an obligation of the Contractor under the terms of this contract.

APPENDIX A

(GEOTECHNICAL REPORT)