



THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 576 - 2005

**2005 CRESCENT DRIVE WASTEWATER SEWER AND PUMPING STATION –
CONTRACT 34**

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PART B - BIDDING PROCEDURES

B1. PROJECT TITLE

- B1.1 2005 CRESCENT DRIVE WASTEWATER SEWER AND PUMPING STATION – CONTRACT 34

B2. SUBMISSION DEADLINE

- B2.1 The Submission Deadline is 12:00 noon Winnipeg time, October 18, 2005..
- B2.2 Bid Submissions 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 GC:3.1, 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 shortly before submitting his Bid.

B5.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 9 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 shall 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 SUBMISSION

B7.1 The Bid Submission consists 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 All components of the Bid Submission 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 in ink, to constitute a responsive Bid.

B7.3 The Bid Submission shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

B7.3.1 Samples or other components of the Bid Submission 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 Submission.

B7.4 Bid Submissions submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B7.5 Bid Submissions 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 owner 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 11 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 owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.

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

B8.4.2 All signatures shall be original and shall 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 Submission 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;
- (b) be responsible and not be suspended, debarred or in default of any obligation to the City;
- (c) be financially capable of carrying out the terms of the Contract;
- (d) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract;
- (e) have successfully carried out work, similar in nature, scope and value to the Work;
- (f) employ only Subcontractors who:
 - (i) are responsible and not suspended, debarred or in default of any obligation 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>); and
 - (ii) have successfully carried out work similar in nature, scope and value to the portion of the Work proposed to be subcontracted to them, and are fully capable of

performing the Work required to be done in accordance with the terms of the Contract;

- (g) have a written workplace safety and health program in accordance with The Workplace Safety and Health Act (Manitoba);

B10.2 Further to B10.1(g), 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 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 - Option 1 administered by the Manitoba Heavy Construction Association's Safety, Health and Environment Program; or
- (b) a valid COR certification number under the Certificate of Recognition (COR) Program administered by the Manitoba Construction Safety Association; or
- (c) 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.>)

B10.3 The Bidder shall be prepared to 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.

B10.4 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.

B11.2 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 Bid Submissions 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 Bid Submissions 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 After the public opening, the names of the Bidders and their Total Bid Prices as read out (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 Submission may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

B13. IRREVOCABLE BID

B13.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 10 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 10 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 GC:23.3, 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 11 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 shall:

- (a) retain the Bid Submission until after the Submission Deadline has elapsed;
- (b) open the Bid Submission to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 11 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 Submission is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements 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 Submission or in other information required to be submitted, that he is responsible and qualified.

B15.4 Further to B15.1(c), the Total 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 by way of a letter of intent, 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 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.

PART C - GENERAL CONDITIONS

C1. GENERAL CONDITIONS

C1.1 The *General Conditions for Construction Contracts* (Revision 2000 11 09) are applicable to the Work of the Contract.

C1.1.1 The *General Conditions for Construction Contracts* 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>.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

- D1.1 In addition to the *General Conditions for Construction Contracts*, these Supplemental Conditions are applicable to the Work of the Contract.
- D1.2 The General Conditions are amended by striking out "The City of Winnipeg Act" wherever it appears in the General Conditions and substituting "The City of Winnipeg Charter".
- D1.3 The General Conditions are amended by striking out "Tender Package" wherever it appears in the General Conditions and substituting "Bid Opportunity".
- D1.4 The General Conditions are amended by striking out "Tender Submission" wherever it appears in the General Conditions and substituting "Bid Submission".
- D1.5 The General Conditions are amended by deleting GC:6.16 and GC:6.17. The City of Winnipeg is now within the jurisdiction of the Manitoba Ombudsman pursuant to The Ombudsman Act.

D2. SCOPE OF WORK

- D2.1 The Work to be done under the Contract shall consist of the construction a new wastewater sewer, wastewater pumping station and forcemain on Crescent Drive in the City of Winnipeg.
- D2.2 The major components of the Work are as follows:
- (a) Supply and installation of approximately 225 metres of 250 millimetre diameter wastewater sewer including manholes.
 - (b) Supply and installation of one fibreglass reinforced plastic "package" or pre-cast concrete wastewater pumping station including two (2) submersible pumps, piping, valves, electrical, ventilation, controls and accessories.
 - (c) Supply and installation of approximately 24 metres of 150 millimetre diameter wastewater forcemain.
 - (d) Supply and install 19 millimetre diameter water service.
 - (e) Wastewater sewer video inspection.
 - (f) Wastewater forcemain hydrostatic leakage testing.
 - (g) Restoration of pavement and boulevard areas.

D3. CONTRACT ADMINISTRATOR

- D3.1 The Contract Administrator is:
Mr. Terry Whiteside, C.E.T.
Design and Specifications Coordinator
849 Ravelston Avenue W.

Telephone No. (204) 986-4451
Facsimile No. (204) 986-5345
- 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 GC:23.2.2, 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 attention of the Chief Financial Officer at the following address or facsimile number:

The City of Winnipeg
Chief Administrative Officer Secretariat
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
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. SAFE WORK PLAN

D7.1 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 GC:4.1 for the return of the executed Contract.

D7.2 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>.

D8. INSURANCE

D8.1 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) all inclusive, with The City of Winnipeg being added as an additional insured, with a cross-liability clause, such liability policy to also contain a contractual liability, an unlicensed motor vehicle liability and a products and completed operations endorsement to remain in place at all times during the performance of the Work and throughout the warranty period;
- (b) automobile liability insurance for owned and non-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) all risks course of construction insurance in the amount of one hundred percent (100%) of the total Contract Price, written in the name of the Contractor and The City of Winnipeg, at all times during the performance of the Work and until the date of Total Performance.

D8.2 Deductibles shall be borne by the Contractor.

D8.3 The Contractor shall provide the City Solicitor with a certificate of insurance of each policy, in a form satisfactory to the City Solicitor, 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 GC:4.1 for the return of the executed Contract.

D8.4 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.

D9. PERFORMANCE SECURITY

D9.1 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.

D9.1.1 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.

D9.2 If the bid security provided in his Bid Submission 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 GC:4.1 for the return of the executed Contract.

D10. SUBCONTRACTOR LIST

D10.1 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 GC:4.1 for the return of the executed Contract.

D11. EQUIPMENT LIST

D11.1 The Contractor shall provide the Contract Administrator with a complete list of the equipment which the Contractor proposes to utilize (Form K: Equipment 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 GC:4.1 for the return of the executed Contract.

D12. DETAILED WORK SCHEDULE

D12.1 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 GC:4.1 for the return of the executed Contract.

D12.2 The detailed work schedule shall consist of the following:

- (a) a critical path method (C.P.M.) schedule for the Work;
- (b) a Gantt chart for the Work based on the C.P.M. schedule;

all acceptable to the Contract Administrator.

D12.3 Further to D12.2(b), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of activity or task. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.

SCHEDULE OF WORK

D13. COMMENCEMENT

D13.1 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.

D13.2 The Contractor shall not commence any Work on the Site until:

- (a) the Contract Administrator has confirmed receipt and approval of:
 - (i) evidence that the Contractor is 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;
 - (ii) evidence of the workers compensation coverage specified in GC:6.14;
 - (iii) the Safe Work Plan specified in D7;
 - (iv) evidence of the insurance specified in D8;
 - (v) the performance security specified in D9;
 - (vi) the Subcontractor list specified in D10;
 - (vii) the equipment list specified in D11;
 - (viii) the detailed work schedule specified in D12; 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.

D13.3 The Contractor shall commence the Work on the Site within seven (7) working days of receipt of the letter of intent.

D14. WORKING DAYS

D14.1 Further to GC:1.1(gg), the Contract Administrator's determination of whether or not atmospheric and Site conditions are such that a Working Day is deemed to have elapsed may be based at one time on one type of work while at another time a Working Day may be based on another type of work. When more than one type of major work is involved, the quantity of equipment that must be able to work in order to meet the requirements of a Working Day may vary considerably from that specified in the General Conditions.

D14.2 In the event that incidental work is behind schedule which, in the opinion of the Contract Administrator, should have been or could have been carried out by the Contractor in conjunction with or immediately following work of a major type, the City hereby reserves the right to charge Working Days on the incidental work until such time as it is up to schedule.

D14.3 When the major type of work involves restoration of the site to the condition it was prior to rainfall, Working Days shall not be charged.

D14.4 The Contract Administrator will furnish the Contractor with a daily record for each major type of work showing various information concerning the equipment, the time it worked, could have worked and Working Days charged. This report is to be signed each day by an authorized representative of the Contractor.

D15. SUBSTANTIAL PERFORMANCE

D15.1 The Contractor shall achieve Substantial Performance within thirty-five (35) consecutive Working Days of the commencement of the Work as specified in D13.

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 re-inspected.

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 within forty-five (45) consecutive Working Days of the commencement of the Work as specified in D13.

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 days fixed herein for same, the Contractor shall pay the City the following amounts per Working Day for each and every Working Day following the days fixed herein for same during which such failure continues:
- (a) Substantial Performance – One thousand dollars (\$1000.00);
 - (b) Total Performance – Five hundred dollars (\$500.00).
- D17.2 The amounts specified for liquidated damages in D17.1 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve Substantial Performance or Total Performance by the days 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) Landscape Maintenance as specified in CW 3510.
- 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. TRAFFIC CONTROL AND MAINTENANCE OF ACCESS

- D20.1 Traffic control shall be carried out in accordance with Section 3.7 of CW 1130 of the General Requirements.
- D20.2 Crescent Drive, east of South Drive, may be closed and signed for "local traffic only" during construction. The Contractor must maintain private approach access at all times.
- D20.3 The Contractor will have access to open lanes of traffic during non-restricted hours provided flag persons 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.

- D20.4 Further to Section 3.6 of CW 1130 of the General Requirements, the Contractor shall maintain safe pedestrian crossing at intersections at all times. If possible, only one pedestrian crossing at an intersection is to be blocked by construction at any one time. If more than 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 locations safe and free of equipment that may hamper pedestrians when no construction activities are being performed at a particular crossing location.
- D20.5 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.
- D21. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)**
- D21.1 Further to GC:6.26, 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).

MEASUREMENT AND PAYMENT

D22. WATER USED ON CITY OF WINNIPEG CONSTRUCTION PROJECTS

- D22.1 Further to Section 3.7 of CW 1120, charges incurred for the permit and water meters shall be paid for by the Contractor when taken out. The Contractor shall forward the invoice to the Contract Administrator for reimbursement. The billing for water usage sent to the Contractor shall be forwarded to the Contract Administrator for payment. The Bid Opportunity number shall be noted on each permit.

FORM H1: PERFORMANCE BOND
(See D9)

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. 576 - 2005

2005 CRESCENT DRIVE WASTEWATER SEWER AND PUMPING STATION – CONTRACT 34

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 D9)

(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. 576 - 2005

2005 CRESCENT DRIVE WASTEWATER SEWER AND PUMPING STATION – CONTRACT 34

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 K: EQUIPMENT
(See D11)

2005 CRESCENT DRIVE WASTEWATER SEWER AND PUMPING STATION – CONTRACT 34

<p>1. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>2. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>3. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>

FORM K: EQUIPMENT
(See D11)

2005 CRESCENT DRIVE WASTEWATER SEWER AND PUMPING STATION – CONTRACT 34

<p>4. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>5. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>
<p>6. Category/type:</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p> <p>Make/Model/Year: _____ Serial No.: _____</p> <p>Registered owner: _____</p>

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS, STANDARD DETAILS AND DRAWINGS

- E1.1 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.
- E1.1.1 *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>.
- E1.1.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.
- E1.1.3 Further to GC:2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.
- E1.2 The following Drawings are applicable to the Work:

<u>Drawing No.</u>	<u>Drawing Name/Title</u>
	Cover Sheet
05688	2005 Crescent Drive Wastewater Sewer and Pumping Station Construction Wastewater Sewer South Drive to 125 m E of South Drive
05689	2005 Crescent Drive Wastewater Sewer and Pumping Station Construction Wastewater Sewer 125 m E of South Drive to 275 m E of South Drive
05690	2005 Crescent Drive Wastewater Sewer and Pumping Station Construction Wastewater Pumping Station Fibreglass Reinforced Plastic Option Plans and Sections
05691	2005 Crescent Drive Wastewater Sewer and Pumping Station Construction Wastewater Pumping Station Pre-Cast Concrete Option Plans and Sections
05692	2005 Crescent Drive Wastewater Sewer and Pumping Station Construction Wastewater Pumping Station Pre-Cast Concrete Option Miscellaneous Details
05693	2005 Crescent Drive Wastewater Sewer and Pumping Station Construction Wastewater Pumping Station Electrical Site Plan
05694	2005 Crescent Drive Wastewater Sewer and Pumping Station Construction Wastewater Pumping Station Lighting, Power and Systems Plan
05695	2005 Crescent Drive Wastewater Sewer and Pumping Station Construction Wastewater Pumping Station Electrical Single Line and Details
05696	2005 Crescent Drive Wastewater Sewer and Pumping Station Construction Wastewater Pumping Station Electrical Schedules and Details

GENERAL REQUIREMENTS

E2. PROVISIONAL ITEMS

- E2.1 The Provisional Items listed in the Schedule of Prices are a part of the Contract.
- E2.2 The Contractor shall not perform Work included in the Provisional Items without prior authorization from the Contract Administrator. All Items of Work included in the Provisional Items will be carried out within the construction areas shown on the Drawings or as indicated by the Contract Administrator.
- E2.3 Notwithstanding GC:7, the City reserves the right to diminish all or any portion of the Items of Work listed in the Provisional Items and no claim shall be made for damages on grounds of loss of anticipated profit or for any other reason.

E3. DANGEROUS WORK CONDITIONS

- E3.1 Further to Clause GC 6.26 of the General Conditions, the Contractor shall be aware that 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.
- E3.2 The Contractor shall be aware of the potential hazards that can be encountered in underground chambers, manholes and sewers such as explosive gases, toxic gases and oxygen deficiency.
- E3.3 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.
- E3.4 The Contractor shall ventilate all confined spaces including underground chambers, tunnels, pipes and shafts as required and approved by the Manitoba Workplace Safety and Health Act (the "Act"). If no ventilation is supplied, a worker must wear a respirator or supplied air to enter the confined space.
- E3.5 Workers must wear a respirator or supplied air at all times when entering an underground chamber, manhole or sewer where live sewage is present.
- E3.6 The Contractor shall provide a photoionization detector (PID) on site at all times to monitor potential hydrocarbon vapours in the confined spaces. The gas detector and safety equipment conforming to the Act shall be made available to the Contract Administrator for his use during inspections. In addition, the Contract Administrator shall collect discrete air samples for laboratory analysis.
- E3.7 The Contract Administrator may issue a stop work order to the Contractor if 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 the stop work order for not following these safety guidelines.

E4. PROTECTION OF EXISTING TREES

- E4.1 The Contractor shall take the following precautionary steps to avoid damage from his construction activities to existing boulevard trees within the limits of the construction area.
- E4.1.1 Do not stockpile materials and soil or park vehicles and equipment on boulevards within 2 metres of trees.
- E4.1.2 Strap mature tree trunks with 25 x 150 x 2400 wood planks. Smaller trees shall be similarly protected using appropriately sized wood planks.
- E4.1.3 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.
- E4.1.4 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.
- E4.1.5 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.

- E4.2 All damage to existing trees due to the Contractor's construction activities shall be repaired to the requirements and satisfaction of the City of Winnipeg, Public Works Department, Forestry Branch.
- E4.3 No separate measurement or payment will be made for protection of trees.
- E4.4 The Contractor shall only remove bush as required to install the watermain and wastewater sewer, subject to approval from the Contract Administrator. The Contractor shall not remove any bush without Contract Administrator approval.

E5. WATERWAY BY-LAW

- E5.1 The Contractor shall note that all work within 107 metres (350 feet) of a riverbank are within the jurisdiction of the Waterway By-Law. The Contract Administrator will apply and pay for required Waterway Permits for the project. The Contractor shall adhere to restrictions imposed by the permit.
- E5.2 Under no circumstances will stockpiling of any material be permitted on within 107 metres of a riverbank or dyke.

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, 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 bear the seal of a registered Engineer of Manitoba.
 - (a) Excavation shoring
 - (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. Shop drawings of separate components of a larger system 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 any corrections required by the Contract Administrator and shall resubmit the required number of corrected copies of Shop Drawings. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections requested by the Contract Administrator on previous submission.
 - (viii) After Contract Administrator's review 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 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 will not be paid for 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.

E6.2 Measurement and Payment

- E6.2.1 Preparation and submittal of Shop Drawings will be included with payment for with "Wastewater Pumping Station."

E7. OPERATING AND MAINTENANCE MANUALS

- E7.1 Operation and maintenance instructions and technical data to be sufficiently detailed with respect to design elements, construction features, component function, correct installation procedure and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation. 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.
- E7.2 Combine operating and maintenance information of various components in binders with the project name identified on the cover. Divide the manual into appropriate sections for the components the information pertains to.
- E7.3 Submit 3 complete copies of operating and maintenance manuals to the Contract Administrator for review. Revise initial manual as required by the Contract Administrator prior to final submission. Make corrections, additions or revisions as required by the Contract Administrator and re-submit 5 complete copies. If there are no corrections, additions or revisions required to the original submission, provide 2 additional complete copies to the Contract Administrator.
- E7.4 The cost of the operating and maintenance manual preparation and submission shall be included in the bid price for "Wastewater Pumping Station".
- E7.5 A holdback of 10% of the unit price provided for "Wastewater Pumping station" will be retained until the final accepted Operating and Maintenance Manuals have been provided to the Contract Administrator.

E8. SURFACE RESTORATIONS

E8.1 Temporary Surface Restoration

- E8.1.1 In the event disturbed surfaces will not be permanently restored until the following spring, temporarily restore disturbed surfaces as follows:
 - (a) Boulevards, ditches and grassed areas – backfill to match existing surface elevation and level area,
 - (b) Gravel Surfaces – 75 millimetre thick layer of 19 millimetre granular material,
 - (c) Asphalt and concrete pavements – 100 millimetre thick layer of concrete complete with plastic bond breaker,
 - (d) Sidewalks – 50 millimetre thick layer of cold mix asphalt or stabilized cement fill levelled to allow safe pedestrian access.
- E8.1.2 Maintain temporary surface restorations until permanent surface restoration is completed.

E8.1.3 If temporarily restored surfaces are not maintained within 24 hours of being notified to do so by the Contract Administrator, the work may be directed to be done by City forces and the cost deducted from any remaining Contract amount.

E8.2 Permanent Surface Restorations

E8.2.1 Permanently restore all existing surface areas disturbed by construction activities including but not limited to areas disturbed by; construction equipment, placement of equipment trailer and where construction materials were stockpiled, shall be restored as follows:

- (a) Boulevards, ditches and grassed areas – sodding using imported topsoil in accordance with CW 3510,
- (b) Gravel surfaces – in accordance with CW 3150,
- (c) Asphalt surfaces – match existing base course and asphalt thickness or a minimum 150 millimetres of base course and 75 millimetres of Type 1A Asphaltic Concrete, whichever is greater, in accordance with CW 3410,
- (d) Miscellaneous concrete slabs, including sidewalk – in accordance with CW 3235,
- (e) Pavement slabs, including private approaches – in accordance with CW 3330,
- (f) Interlocking stones – in accordance with CW 3330,
- (g) Concrete curb and gutter – in accordance with CW 3240.

E8.3 Measurement and Payment

E8.3.1 Costs for temporary and permanent surface restorations shall be included in the Contract Work and no additional payment will be made for such work.

E9. WASTEWATER SEWER

E9.1 Material

E9.1.1 Further to Clause 3.2 and 3.7 of CW 2130, use Class B Bedding. Bedding and initial backfill material to be as follows.

- (a) SDR-35 PVC sewer pipe installation: Type 2 bedding material in accordance with Table CW 2030.1.
- (b) C14 concrete sewer pipe installation: sand bedding in accordance with Table CW 2030.1.

E9.2 Construction Methods

E9.2.1 Install wastewater sewer using trenchless methods in accordance with Clause 3.4 of CW 2130.

E9.2.2 Backfill excavations in accordance with CW 2030 as follows.

- (a) In boulevard areas: Class 5 Backfill
- (b) In pavement areas: Class 3 Backfill

E9.2.3 Install sewer service tees complete with plug on the open end of the tee in accordance with CW 2130 at the locations shown on the Drawings.

E9.2.4 Maintain excavations at sewer service tees for up to 5 days at each location as directed by the Contract Administrator where residents wish to connect private sewer services to the wastewater sewer.

E9.3 Measurement and Payment

- E9.3.1 Maintaining excavations at sewer service tees will be measured for payment on a unit basis and paid for at the Contract Unit Price for "Maintaining Excavations". Number of units to be paid for will be total number of excavations per Working Day that are maintained in accordance with this specification, accepted and measured by the Contract Administrator.

E10. WASTEWATER FORCEMAIN

E10.1 Material

- E10.1.1 As shown on the Drawings.

E10.2 Construction Methods

- E10.2.1 Install wastewater forcemain in accordance with CW 2110. Substitute the word forcemain where the word watermain appears.
- E10.2.2 Backfill excavations in accordance with CW 2030 as follows.
- (a) In boulevard areas: Class 5 Backfill
 - (b) In pavement areas: Class 3 Backfill
- E10.2.3 Connect forcemain to existing manhole in accordance with Clause 3.15 of CW 2130.
- E10.2.4 Perform hydrostatic leakage test on forcemain in accordance with CW 2125. Forcemain does not have to be disinfected.

E10.3 Measurement and Payment

- E10.3.1 Hydrostatic leakage test shall be included in the contact unit price for supplying and installing 150 mm forcemain.

E11. WASTEWATER PUMPING STATION

E11.1 Description

- (a) This specification covers the supply and installation of a wet well type wastewater pumping station complete and ready for operation in accordance with Specifications and Drawings as described herein.
- (b) Generally the pumping station will consist of either an all Fibreglass Reinforced Plastic (FRP) or pre-cast concrete wet well, including top and bottom, all internal piping including valves, 2 electric submersible pumps, electrical controls, ventilation and other components and accessories necessary for reliable operation.
- (c) The station may be pre-assembled with as much equipment and accessories installed as possible except for the pumps and electrical hook-up, thereby allowing reduced installation time.

E11.2 Materials

E11.2.1 Concrete Mix Design

- (a) Concrete mix design: in accordance with Table CW 2160.1 Type A.

E11.2.2 Lean-Mix Concrete Design

- (a) Proportioning of fine aggregate, coarse aggregate, cement, and water for lean mix concrete to be as follows:
 - (i) Cement: Type 50
 - (ii) Minimum Compressive Strength @ 28 days: 15 Mpa

- (iii) Slump: 80 mm
- (iv) Air Content: nil
- (v) Minimum Cement Content = 240 kg/m³
- (vi) Maximum Water/Cement Ratio = 0.49

E11.2.3 Grout

- (a) Grout: Sika Grout 212 or approved equal.

E11.2.4 Reinforcing Steel

- (a) Reinforcing Steel: in accordance with CW 2160.
- (b) Bar accessories:
 - (i) To be made from a non-corroding material.
 - (ii) Shall not stain, blemish or spall the concrete surface for the life of the concrete.
 - (iii) Shall be approved by the Contract Administrator.
 - (iv) Bar chairs shall be PVC.
- (c) Submit Shop Drawings a minimum of two (2) weeks prior to the fabrication of any reinforcing steel.

E11.2.5 Bonding Agent

- (a) Bonding agent: ACRYL-STIX or approved equal.

E11.2.6 Anchor Bolts and Fasteners

- (a) All anchor bolts and fasteners to be ASTM A276, 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.

E11.2.7 Fibreglass Reinforced Plastic (FRP) Type Wet Well

- (a) A vertical cylinder made of FRP constructed integrally with a reinforced bottom capable of withstanding a full hydrostatic head and lateral loading from the exterior of the structure while the structure is completely empty.
- (b) Use a filament winding process in a helical pattern with a winding angle of 60 – 70 degrees from the horizontal axis.
- (c) Provide a minimum 150 millimetre smooth radius moulded corners to minimize the build up of solids.
- (d) Permanently laminate anchor bolts into this solid section and seal watertight.
- (e) Provide secure support lugs to allow for lifting and moving during transportation and placement.
- (f) Finish the interior of the wet well with a smooth bright white mould finish for ease of cleaning and suitable for use in a highly corrosive environment.

E11.2.8 Pre-Cast Concrete Type Wet Well

- (a) Pre-Cast Concrete: in accordance with ASTM C76, Class III.
- (b) Interior coating: shall be corrosion and abrasion resistant such as Tnemec Perma-Glaze Series 435 or an approved equal, and applied to the wet well chamber of the pumping station as per the manufacturer's specifications.

E11.2.9 Submersible Pumps

- (a) In accordance with E12 of this specification.

E11.2.10 Mechanical Piping, Valves and Accessories

- (a) In accordance with E14 of this specification.
- E11.2.11 Electrical
 - (a) In accordance with E15 of this specification.
- E11.2.12 Ventilation
 - (a) In accordance with E15 of this specification.
- E11.2.13 Miscellaneous Metals and Accessories
 - (a) In accordance with E16 of this specification.
- E11.2.14 Water Service
 - (a) Water service pipe to pumping station: 19 millimetre diameter copper in accordance with CW 2110.
 - (b) Curb Stop: in accordance with CW 2110.
 - (c) Curb Stop Box: In accordance with CW 2110.
- E11.2.15 Waterproofing
 - (a) Waterproofing for exterior of pre-cast concrete type wet well: emulsified asphalt in accordance with CAN/CGSB 37.1 or 37.2.
- E11.2.16 Fibreglass Grating
 - (a) Design
 - (i) Grating to be moulded or cultured type made of continuous fibreglass reinforcement.
 - (ii) Fiberglass reinforcement and resin shall be in such qualities, quantities, properties, arrangements and dimensions as necessary to meet the loading requirements for dimensions shown on the Drawings.
 - (iii) Depth: 38 millimetres.
 - (iv) Mesh Configuration: 38 millimetres x 38 millimetres.
 - (v) Grating shall be designed for a uniform load of 489 kg/sm (100 pff) or concentrated load of 136 kg (300 lb). Deflection is not to exceed 9 millimetres (0.375") or $L/D = 120$, whichever is less.
 - (b) Resin
 - (i) Resin shall be Isophthalic Polyester, with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.
 - (c) Finish
 - (i) Finished surfaces shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or un-reinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
 - (ii) Provide a gritted, skid resistant coating bonded to the top of each bar.
 - (d) Moulded Grating
 - (i) Grating shall be of a one piece moulded construction with tops and bottoms of bearing bars and cross bars in the same plane.
 - (ii) Grating shall have a square mesh pattern providing bi-directional strength.
 - (iii) Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer of reinforcement shall be no more than 3 millimetres below the top surface of the grating so as to provide maximum stiffness and prevent resin chipping of unreinforced surfaces.

- (iv) Percentage of glass (by weight) shall not exceed 35% so as to achieve maximum corrosion resistance, and as required to maintain the structural requirements.
 - (v) After moulding, no dry glass fibers shall be visible on any surface of bearing bars or cross bars. All bars shall be smooth and uniform with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas.
 - (vi) Grating bar intersections to be filleted to a minimum radius of 1.5 millimetres to eliminate local stress concentrations and the possibility of resin cracking at these locations.
 - (vii) Grating shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E 84. Data performed only on the resin shall not be acceptable.
- (e) Acceptable products: Fibergrate, IKG Borden, Ryerson Plastics, Chemgrate, Canadian Composite Structures or approved equal.

E11.2.17 Board Insulation

- (a) Board insulation: expanded polystyrene board to CAN/ULC-S701, Type 4, thickness as indicated on Drawings, ship lapped edges, Dow "Styrofoam SM" or approved equal.
- (b) Fasteners: plastic drill and hammer type for attachment of insulation to concrete with large flat head to sit flush with surface of board insulation.

E11.2.18 Pressure Treated Plywood

- (a) Douglas Fir Plywood (DFP): to CSA 0121, pressure treated to CSA 080, thickness as shown on the Drawings.
- (b) Fasteners: zinc plated steel nails with washer suitable for attachment of plywood to concrete.

E11.2.19 Paint and Primer

- (a) In accordance with Formula 2 indicated in E17

E11.2.20 Steel Bollards

- (a) Steel bollards: Concrete filled, 150 millimetre diameter Schedule 40 carbon steel.

E11.2.21 Shop Drawings

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

E11.2.22 Backfill

- (a) In accordance with CW 2030. Class of backfill to be as shown on the Drawings.

E11.3 Construction Methods

E11.3.1 Excavation

- (a) Excavation to be in accordance with CW 2030.
- (b) 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.

E11.3.2 Excavation Security Fence

- (a) 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.
- (b) Security fence shall be chain link fence or approved equal metal grid or mesh, 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 under its own weight and when leaned on.

- (c) Attach fencing securely to posts with metal ties.
- (d) Provide a gate and secure the gate or end of the fencing to a post with chain and a padlock.
- (e) Provide alternate security fence proposal to Contract Administrator for approval.

E11.3.3 Fibreglass Reinforced Plastic (FRP) Wet Well

- (a) Install FRP type wet well as shown on the drawings and in accordance with the manufacturer's instructions. Arrange to have a qualified representative of the FRP wet well manufacturer inspect the installation and provide written documentation it has been installed correctly.
- (b) Construct cast-in-place reinforced concrete foundation for the FRP wet well as shown on the drawings and in accordance with CW 2160.

E11.3.4 Pre-Cast Concrete Wet Well

- (a) Install pre-cast concrete type wet well as shown on the drawings and in accordance with Clause 3.8 and 3.9 of CW 2130.
- (b) Apply interior coating to all interior surfaces in accordance with manufacturer's instructions.
- (c) Paint over interior coating from the intermediate level and above.
- (d) Waterproof below grade portion of the exterior surface of the pre-cast wet well in accordance with CAN/CGSB 37.3 and the waterproofing compound manufacturer's recommendations.

E11.3.5 Water Service

- (a) Install a water service to the pumping station as shown on the drawings using trenchless methods in accordance with CW 2110.
- (b) The Contractor shall supply and install a water shut-off valve and backflow prevention, as indicated on the drawings, inside the pumping station after the waterline enters the station.
- (c) Make arrangements with the City of Winnipeg, Water and Waste Department; to have City staff supply and install a water meter in the pumping station.

E11.3.6 Grout

- (a) Mix and apply grout in accordance with the manufacturers instructions. Consistency to be suitable for the intended application.

E11.3.7 Mechanical Piping, Valves and Accessories

- (a) Install mechanical, piping, valves and accessories as shown on the Drawings and in accordance with E17.

E11.3.8 Submersible Pumps, Guide Rails and lifting Chain

- (a) Install and place into satisfactory operation, submersible pumps, guide rails and lifting chains as shown on the Drawings and in accordance with the manufacturer's instructions.

E11.3.9 Miscellaneous Metal Fabrications

- (a) Install miscellaneous metal fabrications as shown on the Drawings and in accordance with E16 of this specification.

E11.3.10 Fibreglass Grating

- (a) Install support brackets as shown on the Drawings.
- (b) Install fibreglass grating in accordance with manufacturer's instructions.
- (c) Perform field cuts in accordance with manufacturer's recommendations.

E11.3.11 Board Insulation Installation

- (a) Align panels vertical with joints plumb.
- (b) Use full length panels, do not butt smaller pieces of panels together to make required length.
- (c) Attach sheets to concrete wall with plastic anchors at manufacturer's recommended spacing.
- (d) Attach sheets to FRP wall with adhesive compatible with the insulation and FRP and fibreglass reinforced banding at 600 millimetre intervals.

E11.3.12 Pressure Treated Plywood Installation

- (a) Align sheets vertical with joints plumb.
- (b) Stagger plywood joints from board insulation joints.
- (c) Use full-length panels cut a width to match curve of wet well. Do not butt smaller pieces together to make required length.
- (d) Attach sheets to concrete through board insulation. Install fasteners at manufacturer's recommended spacing.
- (e) Attach sheets to FRP wall with adhesive compatible with the insulation and FRP and fibreglass reinforced banding at 600 millimetre intervals.

E11.3.13 Steel Bollards

- (a) Install steel bollards at the locations shown on the Drawings.
- (b) Bollards shall be 1220 millimetre long and 100 millimetre minimum outside diameter steel pipes, complete with metal cap and 150 millimetre long – 9 millimetre chain (welded 325 millimetre from bottom of pipe, and shall be hot-dipped galvanized following fabrication. The foundation for bollards shall consist of a 1220 millimetre deep – 300 millimetre

E11.4 Measurement and Payment

- E11.4.1** Supply and installation of Fibreglass Reinforced Plastic type or Pre-cast Concrete type of wastewater pumping station will be measured on a unit basis and paid for at the Contract Unit Price for "Supply and Installation of Wastewater Pumping Station". The number of units to be paid for will be the total number of wastewater pumping stations supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

E12. SUBMERSIBLE PUMPS

E12.1 Description

- (a) This specification covers the supply of 2 identical submersible pumps for installation in the wastewater pumping station including spare parts and accessories.

E12.2 Materials

E12.2.1 Design Condition

- (a) Rated capacity: each pump must meet or exceed the following operating point:
11.4 L/s (180.0 USgpm) @ 5.4m (17.7 ft) head (includes static head)
- (b) Rotation (viewed from above): CW
- (c) Type of impeller: non-clog
- (d) Size of sphere pump impeller shall pass: 75mm dia.
- (e) Required size of Discharge: 150mm dia.
- (f) Net Positive Suction Head Available: 9.66 m (31.7 ft) maximum
- (g) Maximum Horsepower: 3
- (h) Power Supply: 240 Volt AC, single PH
- (i) Speed: 1800 rpm
- (j) Motor Service Factor: 1.15
- (k) Motor Efficiency @ Full Load: 83% min.
- (l) Percent of Full Load Amps at Given Operating Point: 90% max.
- (m) Motor Speed Torque Characteristics: Nema Design B
- (n) Starts Per Hour Capability: 15 maximum
- (o) CSA Specification Conformance: C 22.2 No. 100

E12.2.2 Pump casing: ASTM A48, Class 30 grey cast iron.

E12.2.3 Impeller: ASTM A48, Class 30 grey cast iron with 3% nickel content.

E12.2.4 Wear Rings:

- (a) Impeller wear ring: ASTM Standard A296 stainless steel minimum 250 Brinell Hardness.
- (b) Volute wear ring: ASTM A48, Class 30 cast iron.

E12.2.5 Pump Shaft: ASTM A276 Type 416 stainless steel.

E12.2.6 Nuts, Bolts and Fasteners: ASTM A276 Type 316 Stainless Steel.

E12.2.7 Guide Rails: Hot dipped galvanized steel or cast iron.

E12.2.8 Lifting Chain: Grade 80 high strength alloy, oblong link, chain, with hot dipped galvanized finish.

E12.3 Construction

E12.3.1 Pump Casing

- (a) Heavy-duty single volute design with an integral centreline discharge outlet.
- (b) Volute shall have smooth passages without blowholes, porosity or other irregularities.
- (c) Pump discharge shall be complete with a flanged connection meeting ANSI flange thickness, dimensions and bolt pattern requirements.
- (d) Sealing of casing components shall be by metal-to-metal contact between machined surfaces.

- (e) Machine surfaces and fit with nitrile rubber O-rings where watertight sealing is required. Provide water-tightness by compressing o-rings in position to make contact on four sides without the requirement of a specific torque requirement.

E12.3.2 Impeller

- (a) Non-clog design capable of handling solids, fibrous material, sludge and other material typically found in raw sewage.
- (b) Dynamically and statically balanced.
- (c) Keyed to the pump shaft and retained with an Allen head bolt

E12.3.3 Wear Rings

- (a) Provide removable wear rings on the suction inlet of the impeller between the impeller and the volute and on the volute.
- (b) Machine wear rings for a close fit to minimize leakage of sewage from the discharge to the suction.
- (c) Attach rings in such a way to allow for ready adjustment or replacement and to prevent loosening under normal operation or under reverse pump rotation.

E12.3.4 Pump Shaft

- (a) Pump and motor shaft shall be an integral piece.
- (b) Size the shaft to transmit rated loads with a liberal safety factor.
- (c) Accurately grind and step shafts to accommodate bearings and the mechanical seal.

E12.3.5 Bearings

- (a) Provide two permanently grease lubricated bearings of sufficient size to transfer all radial and axial loads to the housing while minimizing shaft deflection and heat build-up.
- (b) Provide single roller upper bearing and a two row taper or angular contact lower bearing.
- (c) Design bearings for a B-10 life of not less than 100,000 hours in accordance with AFBMA.

E12.3.6 Mechanical Seals

- (a) Use double type mechanical seal that operate independently from one another in an oil filled reservoir.
- (b) Locate lower seal containing one stationary and one positively driven rotating ring directly behind the impeller. Ring material shall be either tungsten carbide or silicon carbide.
- (c) Locate upper seal containing one stationary tungsten carbide or ceramic seal ring and one positively driven rotating carbon seal ring directly below the motor.
- (d) Each seal to be held in contact by its own spring system.
- (e) Seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing.

E12.3.7 Discharge Assembly

- (a) Provide a quick-disconnecting discharge assembly for each pump consisting of a slide bracket bolted to the pump discharge flange and a mating discharge elbow to allow the pump to be installed and removed from the wet well without personnel entering the wet well.

- (b) Design the assembly so the pump discharge will seat automatically to the discharge elbow with a metal-to-metal contact with the pump in the fully lowered position.
- (c) No part of the pump itself shall bear directly on the wet well floor.

E12.3.8 Guide Rails or Bars

- (a) Provide a minimum of 2 guide rails or bars for each submersible pump extending from the top of the intermediate floor to the discharge elbow.
- (b) Use the following elevations to determine the guide bars or rails length.
 - (i) Wet well floor elevation: 224.250.
 - (ii) Top of intermediate floor elevation: 227.500.
 - (iii) Top of wastewater pumping station: +/- 232.300
- (c) Provide intermediate and end support brackets as required for proper support of the fully loaded guide rails. Intermediate guide rail supports shall not interfere with pump removal and installation.

E12.3.9 Lifting Handle

- (a) Provide a lifting handle for each pump securely bolted to the top of the pumping unit.
- (b) Size the lifting handle for a minimum of 2 times the weight of the pumping unit and any stresses placed on the handle by the lifting or lowering action.

E12.3.10 Lifting Chain

- (a) Provide an 8.0 metre long or as-required length of lifting chain for each pump.
- (b) Size the lifting chain for a minimum of 2 times the weight of the pumping unit, chain itself and any stresses placed on the chain by the lifting or lowering action.
- (c) Attach and secure the lifting chain to the lifting handle on the pumping unit with a removable clevis or other device.

E12.3.11 Pump Motor

- (a) Conform to CSA Specification C22.2 No. 100 and all other CSA Specifications referenced therein.
- (b) Designed and assembled by the same manufacturer
- (c) Provide adequate horsepower so the pump is non-overloading throughout its entire operating range.
- (d) Induction type, squirrel cage rotor design.
- (e) Rotor and stator shall operate in an air filled watertight housing.
- (f) Suitable for full voltage or reduced voltage starting.
- (g) Able to operate, without damage, at full load with voltages from 10% below to 10% above 230 volts.
- (h) 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.
- (i) Each motor will be subject to a maximum of 15 starts per hour and the stator winding insulation suitable for such operation.
- (j) Stator winding insulation to be greater than Class F.
- (k) Embed thermal switches set to open at 125 degrees C in the stator lead coils to monitor the temperature of each phase winding. Thermal switches for phase winding shall be in addition to motor overload protection and shall be connected to the control panel.

- (l) Hermetically seal the junction chamber containing the terminal board from the motor with an elastomeric O-ring seal.
- (m) Make connection between the cable conductors and stator leads with threaded, compression type binding posts permanently affixed to a terminal board.
- (n) Include a leakage sensor to detect water in the stator chamber. Connect the sensor to a switch that stops the motor and sends an alarm to both the local panel and a remote monitoring location when water is detected in the chamber.

E12.3.12 Cooling System

- (a) Provide each pumping unit with an adequately designed, non-clogging, liquid filled, cooling system encircling the stator housing to allow the pump to run continuously at temperatures up to 40 degrees C when not submerged.
- (b) The liquid in the cooling system shall not be sewage, filtered or otherwise.
- (c) Impeller back vanes may be used to provide circulation of the cooling fluid through the cooling system.
- (d) The cooling system shall be accessible from the exterior of the pumping unit.
- (e) Provisions shall also be made for external cooling and seal flushing.

E12.3.13 Surface Coating

- (a) The outside surfaces of each pumping unit shall have an electrostatically applied powder coat, baked on epoxy finish resistant to raw sewage or approved equal.
- (b) Equipment nameplates shall not be painted or coated over.

E12.3.14 Power Cable

- (a) Provide a continuous length of power cable for each pump from the motor control centre to the cable entry on the pump.
- (b) Size power cable according to CEC and CSA requirements.
- (c) Provide an oil resistant chloroprene rubber or approved equal outer jacket for the power cable, suitable for use in raw sewage.

E12.3.15 Power Cable Entry

- (a) Provide a watertight power cable entry consisting of a single elastomer grommet with washers located on each side all having a close tolerance fit against the power cable and the inside diameter of the entry providing a compression fit to seal fluid out.
- (b) Design the assembly to allow easy replacement of cable by using the same entry grommet.
- (c) Separate the cable entry junction chamber and motor by a stator lead sealing gland or terminal board that isolates the interior from fluid.

E12.3.16 Spare Parts

- (a) Provide the following spare parts for the pumping units.
 - (i) 3 impellers.
 - (ii) 3 sets of mechanical seals.
 - (iii) 3 sets of wear rings.
- (b) Spare parts shall be identical to those supplied in the submersible pumps.
- (c) Spare parts shall be properly packaged to resist damage and the package shall be clearly identified as to its contents.

E12.3.17 Tools and Accessories

- (a) Provide special tools or accessories required for maintenance, adjustment, assembly or disassembly of the equipment supplied.

E12.3.18 Operating and Maintenance Manuals

- (a) Provide 5 sets of operating and maintenance manuals documenting maintenance schedule, procedures for adjustment, assembly or disassembly of components, type of fluids to be used and other pertinent information for the proper maintenance of the pumps. Include diagrams with parts list and manufacturer's part number for pumps supplied.

E12.4 Measurement and Payment

- E12.4.1 Supply and installation of submersible pumps, accessories and spare parts as described in E12, are to be included in the Contract Unit Price for "Supply and Installation of Wastewater Pumping Station".

E13. PUMP TESTS AND INITIAL START-UP INSPECTION

E13.1 Description

- (a) This specification covers testing and initial start-up inspection of the submersible pumps supplied and installed in the wastewater pumping station.

E13.2 Testing Methods

- E13.2.1 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.

- E13.2.2 Conduct motor tests in accordance with CSA 22.2 No. 100, EEMAC, MG-2

- (a) In addition to the specified test standards, each motor shall be tested for:
 - (i) Running current
 - (ii) Locked rotor current
 - (iii) Hi-pot test
 - (iv) Winding resistance

E13.3 Shop Tests

- E13.3.1 Test each pump in the manufacturer's shops over the range of operation from shut-off to run-out.

- E13.3.2 Provide a certified test curve in duplicate showing the head, capacity, pump efficiency and power for each pump to the Contract Administrator for approval prior to the pumps being shipped. The pump manufacturer's official responsible for the test shall sign test curves.

E13.4 Initial Start-up Inspection

- E13.4.1 Arrange for a qualified technical representative of the pump supplier to be present at the initial start-up of each submersible pump to confirm the following.

- (a) Pumps have been installed properly.
- (b) Conduct and document amp draw, rotation and speed tests.
- (c) Check for unusual vibration or noises.

- E13.4.2 Provide the Contract Administrator with written documentation from the pump supplier confirming pump installation and operation is satisfactory. Documentation to include a copy of the initial start-up inspection report.

E13.5 Field Capacity Tests

- E13.5.1 Perform field capacity tests on each pump as soon as possible after the supplier has inspected the installation. Method of field capacity testing to be subject to the Contract Administrator's approval.
- E13.5.2 The liquid pumped during the field test will be raw sewage with a density taken to be 1.00 kilogram per litre.
- E13.5.3 If the field pump tests indicate the equipment supplied does not meet the specified capacity requirements, the Contractor shall promptly correct the problem at his expense to the Contract Administrator's satisfaction.

E13.6 Measurement and Payment

- E13.6.1 The cost of providing pump testing and inspection, as described in E13, is to be included in the Contract Unit Price for "Supply and Installation of Wastewater Pumping Station."

E14. MECHANICAL

E14.1 Description

- (a) This specification covers the supply and installation of mechanical piping, valves and accessories for the wastewater pumping station.

E14.2 Materials

E14.2.1 Large Diameter Piping and Fittings

- (a) Ductile iron pipe: to AWWA C151, thickness Class 52.
- (b) Cast iron fittings: to ANSI/AWWA C110/A21.10, 1.0 Mpa working pressure complete with integrally cast flanges.

E14.2.2 Large Diameter Flanges and Adaptor Flanges

- (a) Thread-on flanges for ductile iron pipe: to AWWA C115 or ASME B16.1.
- (b) 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.
- (c) Clamping screws on adapter flanges shall be zinc-plated, heat treated steel with a minimum tensile strength of 28 Mpa.

E14.2.3 Small Diameter Piping, Fittings and Valves (75 millimetre diameter and less)

- (a) Interior water service pipe: to ASTM B.88 Type 'L' third party certified hard copper tube.
- (b) Interior water service fittings: Wrought copper or cast brass, solder joint pressure fitting.
- (c) 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.
- (d) Hose bibs: nickel-plated brass wall faucet with Watts chrome plated vacuum breaker hose end. Crane Model 5046 or approved equal.

- E14.2.4 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 or shall be Watts Model 709.
- E14.2.5 Large Diameter Pipe Supports and Hangers
- (a) Pipe supports and hangers to be as shown on the Drawings.
- E14.2.6 Nuts, Bolts and Fasteners
- (a) Flange nuts and bolts: to ASTM A276, Type 316 stainless steel sized to requirements of flange. Threads on bolts to extend past nut a maximum of 6 millimetres.
 - (b) Concrete anchor bolts shall be ASTM A276, 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.
- E14.2.7 Gaskets
- (a) Flange gaskets: one piece, full faced cloth reinforced, black 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.
- E14.2.8 Level Control
- (a) Flygt Ball level control will be supplied by the Contractor, as indicated on the drawings, complete with all accessories.
- E14.2.9 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 preferred.
 - (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) Attach manufacturer's nameplate to the valve body with stainless steel fasteners.
 - (j) As manufactured by Crane, Jenkins, Kennedy, Mueller, Clown or approved equal.
- E14.2.10 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) Attach manufacturer's nameplate to the valve body with stainless steel fasteners.
 - (e) Acceptable product: Val-Matic Series 500 or approved equal.
- E14.2.11 Wet Well Valve Stem Extension

- (a) 38 millimetre diameter ASTM A276 Type 304 stainless steel, schedule 40 pipe with a 50 mm square operating nut.
- (b) Submit shop drawings of the valve stem extension in accordance with E6 of this specification.

E14.2.12 Wet Well Valve Stem Extension Guide and Wall Brackets

- (a) ASTM A276, Type 304 stainless steel suitable for keeping the stem extension plumb and centered in the valve box while not interfering with the operation of the valve stem.
- (b) Submit shop drawings of the valve stem extension guides and wall brackets in accordance with E8 of this specification.

E14.2.13 Valve Box

- (a) Valve box: upper section in accordance with AP-001, from approved products for underground use in the City of Winnipeg. Mark cover with an "S".

E14.2.14 Paint and Primer for Piping, Valves and Accessories

- (a) In accordance with Formula 1 indicated in E17.

E14.2.15 Ventilation

- (a) Supply and install a 307 l/s (650 cfm), maximum ¼ HP ventilation fan blower in accordance with the Specifications and as detailed on the drawings to provide 30 air exchanges per hour inside the wet well chamber of the pumping station.
- (b) External and Internal fan surfaces to be epoxy coated.
- (c) Acceptable products: Northern Blower, Cook CP series or an approved equal.

E14.2.16 Duct Pipe

- (a) Zinc coated steel strip, spiral 0.60 millimetres (24 ga.) with ribs spaced 150 millimetres apart.
- (b) Duct Sealer: Duro Dyne S-2 duct sealer or an approved equal.

E14.2.17 Submittals

- (a) Submit shop drawings in accordance with E6 for the following:
 - (i) All large and small diameter valves.
 - (ii) Water service backflow preventor.
 - (iii) Platform/support for backflow preventor and meter.
 - (iv) Coupling for water supply.
 - (v) Adjustable rubber seals through openings in walls.
 - (vi) Pipe supports and hangers.

E14.3 Construction Methods

E14.3.1 Large Diameter Piping and Fittings

- (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 t 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 directed by the Contract Administrator.

E14.3.2 Small Diameter Piping, Fittings and Valves

- (a) Install copper water service 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.
- (b) Solder shall be lead free consisting of tin, copper and silver (Silvabrite 100 or equal).
- (c) Valves shall be installed with stems upright or horizontal far enough away from walls and other objects that operation of the handwheel is unobstructed.
- (d) Install dielectric insulating unions between all pipes or apparatus constructed of dissimilar metals. Use brass nipples at flush valves.
- (e) Use a minimum of three layers of teflon tape around threaded fitting ends.
- (f) Test backflow preventers in accordance with manufacturer's recommendations, Contract Administrator's instructions or as required by provincial/ municipal authorities.

- (g) Flush out piping systems before installation of equipment and fixtures to ensure foreign material in piping is removed.
- (h) Pressure test 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.
- (i) 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.
- (j) Arrange with City of Winnipeg, Water and Waste Department, Water Services Branch to install water meter on platform.

E14.3.3 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.

E14.3.4 Level Control

- (a) Install the level control in accordance with the manufacturer's instructions. The Contractor shall have the manufacturer's installation instructions before work begins.

E14.3.5 Wet Well Valve Stem Extension, Guides, Wall Brackets and Valve Box

- (a) Install wet well gate valve, flange adapters, valve stem extension, wall brackets and valve box as shown on the Drawings.

E14.3.6 Painting

- (a) Prime and paint pipe, valves and fittings after the installations are complete in accordance with E17. Provide the Contract Administrator with color samples to choose from prior to any painting being done.

E14.3.7 Ventilation

- (a) Fresh air shall be drawn in through a minimum 150 millimetre diameter air duct with a screened entrance as indicated on the drawings.
- (b) Ventilation shall be allowed to escape from the pumping station through a 150 millimetre diameter exhaust duct as indicated on the drawings.

E14.3.8 General 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.

E14.4 Measurement and Payment

- E14.4.1 Supply and installation of mechanical piping, valves and accessories, are to be included in the Contract Unit Price for "Supply and Installation of Wastewater Pumping Station".

E15. ELECTRICAL

E15.1 Description

- (a) This specification covers the supply and installation of all electrical requirements including power supply, service panels, conduits, fittings and fastenings, wires and cables and other materials for the wastewater pumping station.

E15.2 Materials

- E15.2.1 Provide labour, materials, transportation, equipment and facilities, etc., required for the complete electrical installation as indicated or implied on the drawings and specifications.
- E15.2.2 Electrical equipment shall be new and of type and quality specified. Equipment and material to be CSA certified, and manufactured to standards described. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the appropriate Inspection Departments
- E15.2.3 All equipment shall be suitable for the environment (hazardous / corrosive areas, etc) in which it is installed. In cases where equipment suitability is questionable (ie/ the Contract Administrator and/or Engineer has concerns) the Contractor shall prove that the equipment is suitable (via manufacturer assurance of compliance) or shall replace the equipment at no extra cost.
- E15.2.4 Voltage Ratings
- (a) Operating voltages: to CAN-C235
- E15.2.5 Junction and Pull Boxes
- (a) Boxes shall be EEMAC 4X in all areas
 - (b) Boxes shall be complete with neoprene gaskets and bolted covers
 - (c) Suitably sized threaded watertight hubs complete with insulating nylon throat shall be installed in all boxes which do not contain integral hubs.
 - (d) Boxes shall have external mounting plates or "ears".
 - (e) Junction Boxes shall be c/w hinged cover, quick release cover, fibreglass exposed screws shall be silicone sealed.
 - (f) Approved box manufacturers: Hoffman.
- E15.2.6 Electrical Equipment Supports
- (a) Supports for pull and junction boxes shall be fabricated using green epoxy coated channels and fittings.
 - (b) Supports shall be designed with a minimum safety factor of two (2)
 - (c) Approved Support manufactures: B-Line Duragreen
- E15.2.7 Terminal Blocks
- (a) Terminal blocks shall be installed in all control boxes where Integral terminal blocks are not provided.
 - (b) Terminal blocks and associated fittings shall be Weidmuller (SAK 4) melamine types and sizes or as specified on the drawings.
- E15.2.8 Cable Fittings
- (a) Cable fittings shall be size and type recommended by the cable manufacturer for the installation location (i.e. hazardous or non-hazardous locations) and includes all necessary hardware such as a grounding ring. Cable fittings shall match armour type
 - (b) Approved Cable Fitting manufacturers:
 - (i) Thomas & Betts "Star Teck" connector for non-hazrdous locations.
 - (ii) Thomas & Betts "Star Teck XP" connector for hazrdous locations.
- E15.2.9 Disconnect Switches
- (a) Interlock field disconnect switches to motor starters.

- (b) Approved manufacturers for hazardous and non-hazardous applications: Square D, Cutler Hammer
- (c) Provide provision for padlocking in off switch position.
- (d) ON-OFF switch position indication on switch enclosure cover.
- (e) Provide mechanically interlocked door to prevent opening when handle in the ON position.
- (f) Switches to provide "quick-make" and "quick-break" action.

E15.2.10 Cable Ties

- (a) Cable ties shall be size and type recommended by the cable tie manufacturer for the installation location.
- (b) Approved manufacturers for Cable Ties: Thomas & Betts, 3M Cable Ties.

E15.2.11 Panelboard

- (a) Shall be a lockable, Nema 4 weatherproof, combination service entrance rated panel complete with a main service breaker and M.H. approved meter socket.
- (b) Rated for a minimum of 10,000 Amps Interrupting Capacity.
- (c) Copper bus bars and grounding bus.
- (d) Service Entrance Board: to CAN/CSA-C22.2 No.31.
- (e) Bolt on type breakers
- (f) Approved manufacturers: Schneider, Cutler Hammer, Siemens or approved equal.

E15.2.12 Duplex Pump Controller

- (a) Shall be capable of controlling two 3HP, 230V, single phase submersible pumps
- (b) Shall be equipped with two (2) Hand / Off / Auto switches (1 per pump).
- (c) Shall be equipped with two (2) red pump running lights (1 per pump).
- (d) Shall be equipped complete with 4 float switches: Low Level, Pump1, Pump 2 and High Level Alarm.
- (e) Float switch and float switch cabling shall be Class I, Div. 1 / corrosive environment rated.
- (f) Incorporate pump overheat and leak detection shutdown interlocks complete with alarm output contacts.
- (g) Shall be equipped with 1 N.O. auxiliary alarm contacts.
- (h) Shall be mounted in an exterior Nema 4 rated cabinet and shall be able to operate under extreme winter weather conditions.
- (i) Approved manufacturers: Goulds, Barnes or approved equal.

E15.2.13 Wires and Cables

- (a) Wires
 - (i) Wires to be 600V / 1000V and shall be CSA approved
 - (ii) Wires for installation in conduit shall be stranded copper (solid copper not permitted unless required by code), 600V/1000V rated, black colour, RW90, cross-linked polyethylene insulated type unless otherwise specified on the Drawings.
 - (iii) Conductor size shall be as follows:

- Minimum No. 14 AWG for control and instruments where power requirements are 150 watts or less and fed from an individual circuit breaker; or
- Minimum No. 12 AWG for lighting and power; or
- As specified on the drawings.

(b) Cables

- (i) Cables to be 600V / 1000V and shall be CSA approved.
- (ii) Cables shall be aluminium armoured, stranded, copper conductors, cross linked polyethylene (XLPE) insulated, PVC jacketed TECK type Copper conductors and shall meet ASTM standard requirements.
- (iii) All cables shall meet the Fire Retardance/Flame Test requirements of CAN/CSA-M421-93.
- (iv) Cables shall be multi-conductor type.
- (v) Cables with less than five (5) conductors shall have color-coded insulation or be number coded.
- (vi) Cables with 5 or more conductors shall have the individual conductors number coded.
- (vii) Minimum conductor size shall be as follows:
 - No. 14 AWG copper for control; and
 - No. 12 AWG copper for power and lighting.
- (viii) 600V / 1000V cables shall be non-shielded construction with 100% insulation level.
- (ix) 600V / 1000V cables shall be black jacketed.

(c) Cable Connectors

- (i) Cable connectors shall be Thomas and Betts "Star Teck" connectors for all locations and shall match cable armour and location environment rating.
- (ii) The connector manufacturer's catalogue number, with respect to cable dimensions, shall be verified with the manufacturer prior to placing orders.
- (iii) Connectors of each type shall be manufactured by a single manufacturer.

(d) Phasing Tape

- (i) Phasing tape shall be vinyl, 19 millimetre wide. Phasing shall be as follows: Phase A (red), Phase B (black), and Phase C (blue or white).

E15.2.14 Conduits, Conduit Fastenings and Fittings

(a) Conduits

- (i) Shall be CSA approved.
- (ii) Below grade outdoor conduit shall be Schedule 40 Rigid PVC conduit.
- (iii) Conduit shall be sized in accordance with CSA C22.1 or as indicated on the Drawings.

(b) Conduit Fittings

- (i) Shall be CSA approved.
- (ii) Fittings shall be a pre-manufactured type.
- (iii) Fittings shall be cemented for a watertight connection when installed below grade.

E15.3 Construction Methods

- E15.3.1 The interior of the “wet well” of the wastewater pumping station is classified as a **Class I, Division 1 Hazardous and Corrosive Location**. All wiring, devices and installation methods shall conform to these requirements. Class I, Division 1 cable sealing gland connectors or conduit seals shall be used at the entry and exit of cables into panelboards, junction boxes, control cabinets, disconnects, motor starters, etc, for all cables entering or exiting from the hazardous area. This is done in order to prevent the migration of explosive gases up the conductor or raceway and into the electrical compartment.
- E15.3.2 Coordinate work with all electrical utilities and meet all requirements set forth by the utility in order to provide a new electrical service.
- E15.3.3 Trenches shall be backfilled with compacted sand to within 600 mm of finished grade with treated plank protection to be placed above the conduits.
- E15.3.4 The conduit for the alarm cable shall be placed in the same service trench as the power supply conduit. The Contractor shall leave one continuous length of “fish wire” in the conduit in order to allow cable to be pulled through at a later date.
- E15.3.5 Provide ground electrodes for service grounding.
- E15.3.6 Provide lighting and control as indicated on the drawings.
- E15.3.7 Provide Shop Drawings and five (5) Operations & Maintenance manuals upon project completion.
- E15.3.8 All exterior electrical equipment shall be Nema 4 weatherproof and shall be supported via 150 millimetre galvanized Steel H channels. The H channels shall be encased in concrete pillars sunk 1500 millimetres into the ground. Provide a slab-on-grade concrete housekeeping pad, as shown on the Drawings, for the electrical panels.
- E15.3.9 Do complete installation in accordance with CSA C22.1-2002 except where specified otherwise.
- E15.3.10 Care, Operation and Start-up
- (a) Instruct the Contract Administrator and Operating Personnel in the operation, care and maintenance of systems, system equipment and components.
 - (b) Arrange and pay for services of manufacturer’s factory service engineer to supervise start-up of installation; also to check, adjust, balance and calibrate components and instruct operating personnel.
 - (c) Provide these services for such period and for as many visits as necessary to put equipment into operation. Ensure that operating personnel are conversant with all aspects of care and operation.
- E15.3.11 Voltage Ratings
- (a) Operating voltages: to CAN3-C235-83.
 - (b) Electrical equipment to operate satisfactorily at 60 Hz within normal operating limits established by the above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- E15.3.12 Permits, Fees and Inspection
- (a) Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
 - (b) Pay associated fees.
 - (c) Notify the Contract Administrator of changes required by Electrical Inspection Department or Fire Commissioner prior to making changes.

- (d) Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to the Contract Administrator

E15.3.13 Finishes

- (a) Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

E15.3.14 Identifications Equipment

- (a) Identify electrical equipment with nameplates and labels as follows:

(i) Nameplates:

- Lamacoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached (non-hazardous areas) with self tapping screws. Screws and rivets may not be used to attach lamacoids in hazardous areas where piercing of an enclosure will compromise its integrity. In such cases, straps or chains may be used. Lamacoid sizing shall be adjusted as required in these cases in order to accommodate the mounting methods.
- Wording on nameplates and labels to be approved by Engineer prior to manufacture.
- Allow for average of twenty-five (25) letters per nameplate and label.
- Identification to be English.
- Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- Terminal cabinets and pull boxes: indicate system and voltage
- Transformers: indicate device name, capacity, primary and secondary voltages.
- Panels: indicate device name, voltage, phase

(ii) Nameplate sizes:

- | | | | |
|----------|-------------|---------|--------------------|
| • Size 1 | 10 x 50 mm | 1 line | 3 mm high letters |
| • Size 2 | 12 x 70 mm | 1 line | 5 mm high letters |
| • Size 3 | 12 x 70 mm | 2 lines | 3 mm high letters |
| • Size 4 | 20 x 90 mm | 1 line | 8 mm high letters |
| • Size 5 | 20 x 90 mm | 2 lines | 5 mm high letters |
| • Size 6 | 25 x 100 mm | 1 line | 12 mm high letters |
| • Size 7 | 25 x 100 mm | 2 lines | 6 mm high letters |

E15.3.15 Wiring Identification

- (a) Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- (b) Maintain phase sequence and colour coding throughout.
- (c) Colour code: to CSA C22.1.

E15.3.16 Manufacturer and CSA Labels

- (a) Visible and legible, after equipment is installed.
- (b) All hazardous area devices shall have manufacturer label indicating compliance and suitability for the area installed.

E15.3.17 Warning Signs

- (a) As specified and to meet requirements of Electrical Inspection Department.
- (b) Decal signs, minimum size 175 x 250 mm.

E15.3.18 Field Quality Control

- (a) All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- (b) Carry out tests, as requested, in presence of the Contract Administrator.
- (c) Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- (d) Submit test results for the City's review.

E15.3.19 Codes and Standards

- (a) All components of the Contractor's work shall comply with all applicable laws, regulations, codes, standards and with the regulations of the governing inspection authorities at the place of use, including but not limited to the following:
 - (i) Provincial Electrical Protection Branch Regulations,
 - (ii) Canadian Electrical Codes (CEC) C22.1 and Manitoba Amendments,
 - (iii) Canadian Standards Association (CSA), Standards, Codes and Regulations,
 - (iv) National Electrical Manufacturer's Association (NEMA) Standards,
 - (v) Electrical and Electronic Manufacturer's Association (EEMAC) Standards,
 - (vi) Instrument Society of America (ISA) Standards,
 - (vii) Institute of Electrical and Electronic Engineers (IEEE).

E15.3.20 Supplier – Installer Qualifications

- (a) Installation of materials of this Section shall be carried out by personnel who are able to provide evidence that they meet the current recommended qualifications of
 - (i) The Canadian Interprovincial Standards for Journeyman Electrician in the Electrical Trade or
 - (ii) The Provincial Standards for Journeyman Electrician or Apprentice Electrician in the Electrical Trade.

E15.3.21 Inspection

- (a) Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to the required inspections, tests and approvals.
- (b) Ensure raceways are complete and free from obstructions or sharp edges that may damage cables or conductors;
- (c) Ensure electrical and mechanical equipment installations have advanced to the point where cables installed in or near the equipment will not be damaged;
- (d) Ensure that activities of other trades along cable and wire routes are complete and that cables and conductors will not be damaged by ongoing or future activity.

E15.3.22 General Installation

- (a) All wiring in junction boxes shall be neatly bundled, formed and secured in place with cable ties, or cable straps.

- (b) Securely mount junction boxes on preformed channel supports using bolts and spring type nuts.
- (c) Install junction boxes as required, and in accordance with the drawings.
- (d) Mount junction box in the locations suitable.
- (e) Install terminal blocks as required.
- (f) Equipment supports shall be welded to the structural steel using welding rods compatible with the structure and support materials.
- (g) All surfaces damaged or defaced by the welding procedures shall be repainted in accordance with Structural drawings.
- (h) Final finish color to match the structural steel color.
- (i) Paint grounding connections made to structural steel with insulating paint after connection and respective testing is complete.
- (j) Use mounting bolts and miscellaneous hardware to secure disconnect switches, junction boxes, pull boxes and cable trays, etc., to floors, walls or racks as specified and in accordance with the drawings.

E15.3.23 Wire and Cable

- (a) Remove all debris and foreign matter from trenches, or conduit before installing wires and cables.
- (b) Follow manufacturer's recommended practices when installing cables. Do not damage cable sheaths, conductors or insulation. When pulling cables, do not apply excessive tension that might damage the cables. Use suitable rollers, pulleys, etc., to maintain the recommended bending radius for pulling cables around sharp corners. Replace damaged and rejected cables without additional payment.
- (c) Use non-hardening cable lubricants that do not contain materials injurious to wire and cable.
- (d) Where cables pass through walls, run the cables to avoid interference and protect against mechanical injury.
- (e) Install power conductor's full length, without splices or taps, from origin to destination.

E15.3.24 Inspection and Testing

- (a) Inspect all connections for tightness prior to energizing.
- (b) Test each conductor for insulation resistance and continuity.
- (c) Remedy and make good defects disclosed by such tests and test the work again, repeating until defects are eliminated.

E15.3.25 Cleaning

- (a) Clean all equipment and blow out all dirt with compressed air. Use vacuum cleaner to clean inside of panels.

E15.3.26 Product Delivery, Storage and Handling

- (a) Store materials in an area approved by the Contract Administrator.
- (b) Protect cable ends from ingress of moisture and dirt by sealing the cable ends.
- (c) Minimum bending radius while pulling shall be as follows:
 - (i) 600 V / 1000 V cables - Minimum final bending radius shall be 12 times cable overall diameter.

E15.3.27 Wire and Cable Installation

- (a) Contractor to assume full responsibility for all construction means and co-ordinate with City and other Trades.
- (b) Verify the required cable length prior to cutting or pulling of the cable;
- (c) Install wires and cables as one continuous length between termination points. Splices will not be permitted except within junction boxes;
- (d) Install wire and cables without damage to the jackets, insulation or conductors. Ensure maximum permissible pulling tensions as specified are not exceeded;
- (e) Install phase and ground conductor lugs in accordance with the lug manufacturer's recommendations using dies and tools compatible with the lugs. Contractor shall be responsible to provide necessary tools and dies;
- (f) Install ground lugs and Servit or posts using the specified hardware;
- (g) Conductor insulation shall be colour coded in accordance with the following:
 - (i) Single Phase (AC) 2W
 - Line Red or Black
 - Neutral White
 - (ii) Single Phase (AC) 3W
 - Line Red
 - Line Black
 - Neutral White
 - (iii) Three Phase (AC) 3W, 4W
 - A Phase Red
 - B Phase Black
 - C Phase Blue
 - Neutral White
 - (iv) Ground Wires
 - Equipment Green
 - Instrument Green with red tape on ends
- (h) No more than two (2) conductors shall be terminated on any one (1) side of a terminal block;
- (i) All spare wires in a junction box shall be labelled "SPARE";
- (j) Support all conductors adequately;
- (k) Strip conductor insulation with an approved device, which does not nick or damage the conductor strands;
- (l) Route conductors in control cabinets, junction boxes neatly and collect into bundles. Secure bundles with plastic cable ties or other approved devices. Taping or lacing of conductors is not permitted;
- (m) Assemble conductors serving terminal boards neatly into bundles and secured with cable ties. Three individual conductors exiting the bundle at a spacing to match the terminals on the terminal board;
- (n) Bundle and secure the conductors of an multi-conductor cable with cable ties and anchor or strap to the enclosure. Do not weave the conductors of cables together;
- (o) Ensure conductors in raceways are guided during installation to prevent twisting, kinking, or looping.
- (p) Cables:
 - (i) Strip cables within a panel back to the point of entry and clear of filler, jute, tape, cable jacket and armour;
 - (ii) Clamp all vertical cable runs on Unistrut or approved supports;
 - (iii) Attach individual cables on single runs to structural steel using straps held with threaded impact fastener type pins or bolts. Install cables straight, parallel to building structure;

(iv) Install cables without exceeding the manufacturers recommended pulling tension and bending radius.

(q) Terminations:

- (i) Use lugs, terminals and screws suitable for copper conductors;
- (ii) Connect no more than two wires to a single terminal block connection point;
- (iii) Bond ground conductors and cable armour to ensure continuity of the grounding network.

E15.3.28 Conduit and Conduit Fittings Installation

- (a) Fittings shall be pre-manufactured type.
- (b) Fittings shall be cemented for a watertight connection when installed below grade.
- (c) Do not allow or cause any work performed or installed to be covered up or enclosed by work of this Section prior to the required inspections, tests and approvals.
- (d) Inspect conduit routing to determine any conflict with other trades. Inform the Contract Administrator of any conflicts and make adjustments as determined by the Contract Administrator.
- (e) Assume full responsibility for all construction means and co-ordinate with Contract Administrator and other Trades.
- (f) Install conduit in accordance with the drawings and the manufacturer's recommendations.
- (g) Supply seal fittings and compound to seal conduits, cables, and grounding conductor.

E15.4 Measurement and Payment

E15.5 Supply and installation of all electrical material, equipment and accessories as described in E15 are to be included in the Contract Unit Price for "Supply and Installation of Wastewater Pumping Station".

E16. MISCELLANEOUS METAL FABRICATIONS

E16.1 Description

E16.1.1 General

- (a) This Specification covers the supply, fabrication, transportation, handling, delivery and installation of miscellaneous metal fabrications.

E16.2 Materials

E16.2.1 General

- (a) All materials shall be of a type acceptable to the Contract Administrator, and shall be subject to inspection and testing by the Contractor Administrator.
- (b) Material intended for use in the various assemblies shall be new, straight, clean, with sharply defined profiles.

E16.2.2 Steel Sections and Plates

- (a) To CAN/CSA G40.20/G40.21, Grade 300 W, except W, HP and HSS sections, which shall be Grade 350 W.

E16.2.3 Steel Pipe

- (a) To ASTM A53/A53M, seamless, galvanized, as specified by item.

E16.2.4 Welding Materials

- (a) To CSA W59.
- E16.2.5 Hot Dipped Galvanized Steel Repair Material
 - (a) Galvalloy and Gal-Viz
- E16.2.6 Stud Anchors
 - (a) To ASTM A108, Grade 1020.
- E16.2.7 Aluminium
 - (a) To CAN/CSA S157 and the Aluminium Association 'Specifications for Aluminium Structures'. Aluminium for plates shall be Type 6061-T651. Aluminium plate shall have an approved raised oval or multi-grip pattern.
- E16.2.8 Isolating Sleeves
 - (a) "Hyalite" – headed sleeve as manufactured by SPAE-Nauru of Kitcheners, Ontario, or approved equal.
- E16.2.9 Anchor Bolts and Fasteners
 - (a) ASTM A276, 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.
- E16.3 Construction Methods
 - E16.3.1 Submittals
 - (a) Submit the qualifications of the fabricator and welders to the Contractor Administrator for acceptance.
 - (b) Submit shop drawings in accordance with E6 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.
 - E16.3.2 Fabrication
 - (a) Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured. Assemble work in such a way that no disfigurements will show in the finished work, or impair the strength.
 - (b) Confirm measurements for all fabrications before fabricating.
 - (c) Cut aluminium plate with edges straight and true, and as far as practical, maintain continuity of the pattern at abutting edges.
 - (d) Pieces shall be of the sizes indicated on the Drawings and shall not be built up from scrap pieces. Confirm sizes with field measurements.
 - (e) Fit work and shop assemble, ready for erection where possible.
 - (f) Use same material for angle frames as for cover plates.
 - (g) Supply cover plates with hinges and lifting handles as shown on the Drawings. Provide hasp suitable for a padlock for exterior covers.
 - (h) Remove and grind smooth burrs, filings, sharp protrusions, and projections from metal fabrications to prevent possible injury. Correct dangerous or potentially harmful installations as directed by Contract Administrator.
 - (i) Steel welding to conform to CSA Standard W.59. Fabricator to be fully approved by the Canadian Welding Bureau, in conformance with CSA Standard W.47.1. Welding to be done by currently licensed welders only.

- (j) Aluminium welding to conform to Welding and be in accordance with the requirements of CSA W59.2. Fabricator to be fully certified in conformance with CSA Standard W47.2. All welding to be done in a licensed welding shop. Obtain Contract Administrator's approval to do field welding.
- (k) Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- (l) Hot-dip galvanize steel after fabrication, in accordance with CAN/CSA-G164, to a minimum net retention of 600 gm/m².
- (m) Seal exterior steel fabrications to provide corrosion protection in accordance with CAN3-S16.1.
- (n) Use self-tapping, shake-proof, flat-headed screws on items requiring assembly by screws.

E16.3.3 Erection

- (a) Steel welding work to be done in accordance with CSA W59.
- (b) Aluminium welding work to be in accordance with CSA W59.2
- (c) Provide components for building in accordance with Shop Drawings and schedule.
- (d) Erect metalwork in accordance with reviewed shop drawings, square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- (e) Provide suitable means of anchorage acceptable to Contract Administrator such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles where not specifically indicated on the Drawings.
- (f) Make field connections with bolts to CAN/CSA-S16, or weld.
- (g) Touch-up rivets, bolts and burnt or scratched surfaces that are to receive paint finish, with zinc primer after completion of erection.
- (h) Repair 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. The general procedure shall be to allow a small amount of the repair alloy to flow then spread by brushing briskly with a wire brush. Brushing shall be sufficient to obtain a bright finish. Repeat process three times to ensure a proper thickness is achieved. Temperatures shall be kept below 177°C (350°F) at all times. All heating of structural steelwork shall be done in the presence of the Contract Administrator.
- (i) Install access hatch frames square and level at the locations show on the Drawings. Embed anchors in concrete as shown on the Drawings. Install covers and adjust hardware to proper function.
- (j) Isolate aluminium surfaces in contact with concrete using alkali-resistant bituminous paint meeting the requirements of CGSB 31-GP-3M.
- (k) Install electrochemical isolation gaskets and sleeves to electrically isolate dissimilar metals.

E16.4 Measurement and Payment

- E16.4.1 Supply, fabrication, transportation, handling, delivery and installation of miscellaneous metal fabrications to be included in the Contract Unit Price for "Supply and Installation of Wastewater Pumping Station".

E17. PAINT

E17.1 Description

E17.1.1 General

- (a) This specification shall cover supply and application of paint and associated work for the items included.

E17.2 Materials

E17.2.1 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.

E17.2.2 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 alkyd 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.

E17.3 Construction Methods

E17.3.1 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.

E17.3.2 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.

E17.3.3 Safety Requirements

- (a) Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

E17.3.4 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 City and store as directed.

E17.3.5 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.

E17.3.6 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.

E17.3.7 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.

E17.3.8 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.

E17.4 Measurement and Payment

- E17.4.1 Supply and application of paint will be included in the Contract Unit Price for "Supply and Instalation of Wastewater Pumping Station".