THE CITY OF WINNIPEG

TENDER

TENDER NO. 1010-2024B

CONSTRUCTION OF THE REPLACEMENT FORT GARRY-ST. VITAL SIPHONS

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PART B - BIDDING PROCEDURES

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B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, June 6, 2025.

B2.2 The Contract Administrator or the Manager of Purchasing may extend the Submission Deadline by issuing an addendum at any time prior to the time and date specified in B2.1.

B3. SITE INVESTIGATION

B3.1 Further to C3.1, the Bidder may view the Site without making an appointment, provided the Bidder notifies the Contract Administrator at least two (2) Business Days prior to the intended inspection dates for coordination, as required, with the Emergency Bypass Contractor listed in D22.2(a).

B3.2 The Bidder/Proponent is responsible for inspecting the Site, the nature of the Work to be done and all conditions that might affect their Bid/Proposal or their performance of the Work, and shall assume all risk for conditions existing or arising in the course of the Work which have been or could have been determined through such inspection

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D7.1.

B4.2 If the Bidder finds errors, discrepancies or omissions in the Tender, 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 Tender 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 Tender 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.

B4.6 Any enquiries concerning submitting through MERX should be addressed to:
MERX Customer Support
Phone: 1-800-964-6379
Email: merx@merx.com

B5. CONFIDENTIALITY

B5.1 Information provided to a Bidder by the City or acquired by a Bidder by way of further enquiries or through investigation is confidential. Such information shall not be used or disclosed in any way without the prior written authorization of the Contract Administrator. The use and disclosure of the confidential information shall not apply to information which:

(a) was known to the Bidder before receipt hereof; or

(b) becomes publicly known other than through the Bidder; or

(c) is disclosed pursuant to the requirements of a governmental authority or judicial order.

B5.2 The Bidder shall not make any statement of fact or opinion regarding any aspect of the Tender to the media or any member of the public without the prior written authorization of the Contract Administrator.

B6. ADDENDA

B6.1 The Contract Administrator may, at any time prior to the Submission Deadline, issue addenda correcting errors, discrepancies or omissions in the Tender, or clarifying the meaning or intent of any provision therein.

B6.2 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.

B6.3 Addenda will be available on the MERX website at www.merx.com.

B6.4 The Bidder is responsible for ensuring that they have received all addenda and is advised to check the MERX website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.

B6.5 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid/Proposal. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B6.6 Notwithstanding B4, enquiries related to an Addendum may be directed to the Contract Administrator indicated in D7.

B7. SUBSTITUTES

B7.1 The Work is based on the Plant, Materials and methods specified in the Tender.

B7.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B7.3 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.

B7.4 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.

B7.5 The Contract Administrator, after assessing the request for approval of a substitute, may in their 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.

B7.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, to the Bidder who requested approval of the substitute.

B7.6.1 The Contract Administrator will issue an Addendum, disclosing the approved materials, equipment, methods and products to all potential Bidders. The Bidder requesting and obtaining the approval of a substitute shall be responsible for disseminating information regarding the approval to any person or persons they wish to inform.

B7.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.

B7.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative may base their 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 B18.

B7.9 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.

B8. BID COMPONENTS

B8.1 The Bid shall consist of the following components:

(a) Form A: Bid/Proposal;

(b) Form B: Prices;

(c) Form G1: Bid Bond and Agreement to Bond.

B8.2 All components of the Bid shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely.

B8.3 The Bid shall be submitted electronically through MERX at www.merx.com.

B8.3.1 Bids will **only** be accepted electronically through MERX.

B8.4 Bidders are advised that inclusion of terms and conditions inconsistent with the Tender document, including the General Conditions, will be evaluated in accordance with B18.1(a).

B9. BID

B9.1 The Bidder shall complete Form A: Bid/Proposal, making all required entries.

B9.2 Paragraph 2 of Form A: Bid/Proposal shall be completed in accordance with the following requirements:

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

B9.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B9.2.

B9.3 In Paragraph 3 of Form A: Bid/Proposal, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.

B9.4 Paragraph 13 of Form A: Bid/Proposal shall be signed in accordance with the following requirements:

(a) if the Bidder is a sole proprietor carrying on business in their 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 their duly authorized officer or officers;

(d) if the Bidder is carrying on business under a name other than their 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.

B9.4.1 The name and official capacity of all individuals signing Form A: Bid/Proposal should be entered below such signatures.

B9.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid and the Contract, when awarded, shall be both joint and several.

B10. PRICES

B10.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.

B10.2 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.

B10.3 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.

B10.4 Payments to Non-Resident Contractors are subject to Non-Resident Withholding Tax pursuant to the Income Tax Act (Canada).

B10.5 The Bidder shall enter the Total Bid Price from Form B: Prices into the Total Bid Price field in MERX.

B10.5.1 Bidders are advised that the calculation indicated in B18.4 will prevail over the Total Bid Price entered in MERX.

B11. DISCLOSURE

B11.1 Various Persons provided information or services with respect to this Work. In the City's opinion, this relationship or association does not create a conflict of interest because of this full disclosure. Where applicable, additional material available as a result of contact with these Persons is listed below.

B11.2 The Persons are:

(a) Michels Canada Co. – constructability assessment.

(b) Ward and Burke Microtunnelling Ltd. – constructability assessment.

(c) Nelson River Construction Inc. – construction and maintenance of pumping station bypass pumps and piping.

B12. CONFLICT OF INTEREST AND GOOD FAITH

B12.1 Further to C3.2, Bidders, by responding to this Tender, declare that no Conflict of Interest currently exists, or is reasonably expected to exist in the future.

B12.2 Conflict of Interest means any situation or circumstance where a Bidder or employee of the Bidder proposed for the Work has:

(a) other commitments;

(b) relationships;

(c) financial interests; or

(d) involvement in ongoing litigation;

that could or would be seen to:

(i) exercise an improper influence over the objective, unbiased and impartial exercise of the independent judgment of the City with respect to the evaluation of Bids or award of the Contract; or

(ii) compromise, impair or be incompatible with the effective performance of a Bidder's obligations under the Contract;

(e) has contractual or other obligations to the City that could or would be seen to have been compromised or impaired as a result of their participation in the Tender process or the Work; or

(f) has knowledge of confidential information (other than confidential information disclosed by the City in the normal course of the Tender process) of strategic and/or material relevance to the Tender process or to the Work that is not available to other bidders and that could or would be seen to give that Bidder an unfair competitive advantage.

B12.3 In connection with their Bid, each entity identified in B12.2 shall:

(a) avoid any perceived, potential or actual Conflict of Interest in relation to the procurement process and the Work;

(b) upon discovering any perceived, potential or actual Conflict of Interest at any time during the Tender process, promptly disclose a detailed description of the Conflict of Interest to the City in a written statement to the Contract Administrator; and

(c) provide the City with the proposed means to avoid or mitigate, to the greatest extent practicable, any perceived, potential or actual Conflict of Interest and shall submit any additional information to the City that the City considers necessary to properly assess the perceived, potential or actual Conflict of Interest.

B12.4 Without limiting B12.3, the City may, in their sole discretion, waive any and all perceived, potential or actual Conflicts of Interest. The City's waiver may be based upon such terms and conditions as the City, in their sole discretion, requires to satisfy itself that the Conflict of Interest has been appropriately avoided or mitigated, including requiring the Bidder to put into place such policies, procedures, measures and other safeguards as may be required by and be acceptable to the City, in their sole discretion, to avoid or mitigate the impact of such Conflict of Interest.

B12.5 Without limiting B12.3, and in addition to all contractual or other rights or rights at law or in equity or legislation that may be available to the City, the City may, in their sole discretion:

(a) disqualify a Bidder that fails to disclose a perceived, potential or actual Conflict of Interest of the Bidder or any of their employees proposed for the Work;

(b) require the removal or replacement of any employees proposed for the Work that has a perceived, actual or potential Conflict of Interest that the City, in their sole discretion, determines cannot be avoided or mitigated;

(c) disqualify a Bidder or employees proposed for the Work that fails to comply with any requirements prescribed by the City pursuant to B12.4 to avoid or mitigate a Conflict of Interest; and

(d) disqualify a Bidder if the Bidder, or one of their employees proposed for the Work, has a perceived, potential or actual Conflict of Interest that, in the City's sole discretion, cannot be avoided or mitigated, or otherwise resolved.

B12.6 The final determination of whether a perceived, potential or actual Conflict of Interest exists shall be made by the City, in their sole discretion.

B13. QUALIFICATION

B13.1 The Bidder shall:

(a) undertake to be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba; and

(b) be financially capable of carrying out the terms of the Contract; and

(c) have all the necessary experience, capital, organization, and equipment to perform the Work in strict accordance with the terms and provisions of the Contract.

B13.2 The Bidder and any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

(a) be responsible and not be suspended, debarred or in default of any obligations to the City. A list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Purchasing Division website at https://www.winnipeg.ca/matmgt/Templates/files/debar.pdf

B13.3 The Bidder and/or any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

(a) have successfully carried out work similar in nature, scope and value to the Work; and

(b) be fully capable of performing the Work required to be in strict accordance with the terms and provisions of the Contract; and

(c) have a written workplace safety and health program if required pursuant to The Workplace Safety and Health Act (Manitoba);

(d) have completed the Accessible Customer Service online training required by the Accessibility for Manitobans Act (AMA) (see B13.5 and D9)

(e) Be a prequalified Contractor:

(i) The City has, through a Request for Qualification process (RFQ No. 1010-2024A), identified Microtunnelling Contractors who have successfully prequalified to participate in this project. Only submissions from a prequalified Contractor will be accepted. Any Bid received from a Bidder who is not a prequalified Microtunnelling Contractor will be rejected.

(f) Further to B13.3(e), the following Contractors have been pre-qualified through the Request for Qualification process (RFQ No. 1010-2024A):

(i) Bothar Inc.

(ii) Erritt Construction Ltd.

(iii) Michels Canada Co.

(iv) Ward and Burke Microtunnelling Ltd.

B13.4 Further to B13.3(c), the Bidder shall, within five (5) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder/Subcontractor has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

(a) Written confirmation of a safety and health certification meeting SAFE Work Manitoba's SAFE Work Certified Standard (e.g., COR™ and SECOR™) in the form of:

(i) a copy of their valid Manitoba COR certificate and Letter of Good Standing (or Manitoba equivalency) as issued under the Certificate of Recognition (COR) Program administered by the Construction Safety Association of Manitoba or by the Manitoba Heavy Construction Association's WORKSAFELY™ COR™ Program; or

(ii) a copy of their valid Manitoba SECOR™ certificate and Letter of Good Standing (or Manitoba equivalency) as issued under the Small Employer Certificate of Recognition Program (SECOR™) administered by the Construction Safety Association of Manitoba or by the Manitoba Heavy Construction Association's WORKSAFELY™ COR™ Program; or

(b) a report or letter to that effect from an independent reviewer acceptable to the City. A list of acceptable reviewers and the review template are available at http://www.winnipeg.ca/matmgt/Safety/default.stm.

B13.5 Further to B13.3(d), the Bidder acknowledges that they and all Subcontractors have obtained training required by the Accessibility for Manitobans Act (AMA) available at https://accessibilitymb.ca/resources-events-and-training/online-training.html for anyone that may have any interaction with the public on behalf of the City of Winnipeg.

B13.6 The Bidder shall submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B13.7 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.

B14. BID SECURITY

B14.1 The Bidder shall include in their Bid Submission bid security in the form of a digital 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 Form G1: Bid Bond and Agreement to Bond, available: https://www.winnipeg.ca/media/4929/.

B14.2 Bid security shall be submitted in a digital format meeting the following criteria:

(a) The version submitted by the Bidder must have valid digital signatures and seals;

(b) The version submitted by the Bidder must be verifiable by the City with respect to the totality and wholeness of the bond form, including: the content; all digital signatures and digital seals; with the surety company, or an approved verification service provider of the surety company.

(c) The version submitted must be viewable, printable and storable in standard electronic file formats compatible with the City, and in a single file. Allowable formats include pdf.

(d) The verification may be conducted by the City immediately or at any time during the life of the bond and at the discretion of the City with no requirement for passwords or fees.

(e) The results of the verification must provide a clear, immediate and printable indication of pass or fail regarding B14.2(a).

B14.3 Bonds failing the verification process will not be considered to be valid and the bid shall be determined to be non-responsive in accordance with B18.1(a).

B14.4 Bonds passing the verification process will be treated as original and authentic.

B14.4.1 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.

B14.5 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 formed with the successful Bidder and the contract securities are furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

B14.6 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 Tender.

B15. OPENING OF BIDS AND RELEASE OF INFORMATION

B15.1 Bids will not be opened publicly.

B15.2 Following the Submission Deadline, the names of the Bidders and their Total Evaluated Bid Prices (unevaluated and pending review and verification of conformance with requirements) will be available on the MERX website at www.merx.com.

B15.3 After award of Contract, the name(s) of the successful Bidder(s) and their Contract amount(s) will be available on the MERX website at www.merx.com.

B15.4 The Bidder is advised that any information contained in any Bid may be released if required by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law or by City policy or procedures (which may include access by members of City Council).

B15.4.1 To the extent permitted, the City shall treat as confidential information, those aspects of a Bid Submission identified by the Bidder as such in accordance with and by reference to Part 2, Section 17 or Section 18 or Section 26 of The Freedom of Information and Protection of Privacy Act (Manitoba), as amended.

B16. IRREVOCABLE BID

B16.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid/Proposal.

B16.2 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 formed and the contract securities have been furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid/Proposal.

B17. WITHDRAWAL OF BIDS

B17.1 A Bidder may withdraw their Bid without penalty at any time prior to the Submission Deadline.

B18. EVALUATION OF BIDS

B18.1 Award of the Contract shall be based on the following bid evaluation criteria:

(a) compliance by the Bidder with the requirements of the Tender, or acceptable deviation there from (pass/fail);

(b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B13 (pass/fail);

(c) Total Evaluated Bid Price;

(d) economic analysis of any approved alternative pursuant to B7.

B18.2 Further to B18.1(a), the Award Authority may reject a Bid as being non-responsive if the Bid is incomplete, obscure or conditional, or contains additions, deletions, alterations or other irregularities. The Award Authority may reject all or any part of any Bid, or waive technical requirements or minor informalities or irregularities, if the interests of the City so require.

B18.3 Further to B18.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in their Bid or in other information required to be submitted, that they are qualified.

B18.4 Further to B18.1(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.

B18.4.1 Bidders are advised that the calculation indicated in B18.4 will prevail over the Total Bid Price entered in MERX.

B18.4.2 Further to B18.1(a), in the event that a unit price is not provided on Form B: Prices, the City may determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.

B18.4.3 Further to B18.1(c) the Total Evaluated Bid Price shall include Daily Equipment Costs as shown on Form B: Prices. Daily Equipment Costs are formulated as described in E15.

B18.5 Further to B18.1(c), the Award Authority may reject a Bid as non-responsive if it exceeds the funds available as shown in D4.3.

B19. AWARD OF CONTRACT

B19.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B19.2 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 qualified, and the Bids are determined to be responsive.

B19.2.1 Without limiting the generality of B19.2, 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 their 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.

B19.3 Where an award of Contract is made by the City, the award shall be made to the qualified Bidder submitting the lowest evaluated responsive Bid, in accordance with B18.

B19.3.1 Following the award of contract, a Bidder will be provided with information related to the evaluation of their Bid upon written request to the Contract Administrator.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

C0.1 The *General Conditions for Construction* (Revision 2020-01-31) are applicable to the Work of the Contract.

C0.1.1 The *General Conditions for Construction* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Purchasing Division website at http://www.winnipeg.ca/matmgt/gen_cond.stm

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

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

D2. FORM OF CONTRACT DOCUMENTS

D2.1 Notwithstanding C4.1(c) and C4.4, the Contract Documents will be provided to the Contractor electronically and there will be no requirement for execution and return to the City by the Contractor. Accordingly, the provisions under C4.4(a) and C4.4(b) are no longer applicable.

D3. PROJECT BACKGROUND

D3.1 During planned inspections in late 2023, the original FGSV siphons crossing the Red River were found to be in poor condition, where one of the siphons was assessed to be leaking and put out of service. Planning was immediately commenced to install an emergency bypass system across the Red River, via the east bound Fort Garry Road Bridge on Abinojii Mikanah. On February 7, 2024, AECOM was notified by City of Winnipeg Water and Waste Department (WWD) of a sinkhole on the west bank of the river, which indicated the partial collapse and subsequent failure of the second siphon. Design and implementation of an emergency bypass system began in December 2023. Construction on site of the bypass commenced on February 5, 2024.

D3.2 The City has indicated that a new subsurface crossing of the Red River as the permanent replacement of the failed original crossing, which when implemented will allow the City to decommission the emergency bypass.

D3.3 Review of hydraulic requirements and site constraints have resulted in a recommendation for the use of microtunnelling for installation of a new siphon river crossing consisting of a 2100 mm casing pipe for two (2) 900 mm carrier pipes.

D3.4 It is in the City's best interest to commission the new FGSV siphon crossing to allow for abandonment of the Emergency Bypass and restore to the site to original conditions.

D4. SCOPE OF WORK

D4.1 The Work to be done under the Contract shall consist of a new sewer river crossing (siphon) under the Red River that is approximately 380 m in length consisting of a 2100 mm primary casing pipe and two (2) 900 mm carrier pipes pulled through on casing spacers, 1350 mm connection trunks to the existing trunk system, modifications to existing subterranean structures and all required Work associated with the installation of the above.

D4.2 The major components of the Work are as follows:

(a) Demolition of the existing cast-in-place discharge chamber from the D'Arcy Waste Water Pumping Station

(b) Installation of new cast-in-place discharge chamber receiving flows from the D'Arcy Lift Station 500 mm AC force main conveys flow to the siphon system.

(i) Cast in place concrete structure, fitted with a weir to the gravity overflow.

(ii) Installation of new flap gates to the four (4) overflow cross connections.

(c) Rehabilitation of the existing 1350 mm gravity sewer and outfall, which will be used as the gravity overflow of the new FGSV siphon crossing.

(i) 1350 mm reinforced concrete pipe (RCP) gravity sewer will be rehabilitated by CIPP methods.

(d) Temporary relocation of Active Transportation paths.

(e) Trenchless installation of approximately 70 m long 1350 mm RCP connecting the new discharge chamber to the upstream siphon chamber crossing Abinojii Mikanah.

(f) Installation of MTBM launch and receiving shafts.

(g) Installation of approximately 350 long river crossing (siphon) using Microtunneling:

(i) 2100 mm internal diameter primary casing pipe through underlying limestone bedrock strata.

(ii) Two (2) 900 mm DR 11 HDPE carrier pipe to be pulled through casing pipe on casing spacers.

(h) Trenchless installation of approximately 70 m long 1350 mm RCP connecting the new downstream siphon chamber to the connection manhole at the St. Vital Trunk.

(i) Conversion of the launch and receiving shafts into final chamber configuration.

(i) Installation of chamber foundation and walls (if not part of construction shafts).

(ii) Installation of permanent roof and service access projection to grade.

(iii) Installation of intermediate floor(s), ladders, lighting, and other man-entry accommodations.

(j) Installation of chamber appurtenances.

(k) Site restoration works and new Land Drainage Sewers.

D4.3 The funds available for this Contract are $20,100,000.00.

D4.4 The following shall apply to the Work:

(a) City of Winnipeg Green Building Policy: New City-Owned Buildings and major additions;

http://clkapps.winnipeg.ca/DMIS/DocExt/ViewDoc.asp?DocumentTypeId=2&DocId=5989

(b) Universal Design Policy

http://clkapps.winnipeg.ca/DMIS/DocExt/ViewDoc.asp?DocumentTypeId=2&DocId=3604

D5. SITE INVESTIGATION DUE DILIGENCE AND RISK

D5.1 Notwithstanding C3.1, the Contractor acknowledges that the site investigation reports and other site information included in this Tender have been provided to it and may be relied upon by the Contractor to the extent that the Contractor uses Good Industry Practice in interpreting such report(s) and site information and carries out the Work in accordance with Good Industry Practice based upon such report(s) and the information contained in them and such other site information. In the event that a site condition related to:

(a) the location of any utility which can be determined from the records or other information available at the offices of any public authority or person, including a municipal corporation and any board or commission thereof, having jurisdiction or control over the utility;

(b) the Site conditions, including but not limited to subsurface hazardous materials or other concealed physical conditions;

(c) the location, nature, quality or quantity of the materials to be removed or to be employed in the performance of the Work;

(d) the nature, quality or quantity of the Plant needed to perform the Work;

(e) all matters concerning access to the Site, power supplies, location of existing services, utilities or materials necessary for the completion of the Work; and

(f) all other matters which could in any way affect the performance of the Work;

that could not have been “properly inferable”, “readily apparent” and readily discoverable” using Good Industry Practice by the Contractor, results in additional Work which is a direct result of

this newly discovered site condition, such additional Work will be considered by the City under Changes in Work.

D6. DEFINITIONS

D6.1 When used in this Tender:

(a) "**ACI**" means American Concrete Institute;

(b) "**ASTM**" means American Society for Testing and Materials;

(c) "**AWWA**" means American Water Works Association;

(d) "**Benchmark**" means a permanent reference control point established by the Contractor;

(e) "**Building/Structure Monitoring Point**" (BMP) means a structural monitoring point used to monitor horizontal and vertical deformation of structures. BMPs shall consist of non-destructive and stable elements firmly attached to structures with locations clearly identified;

(f) "**Carrier Pipe**" means the permanent pipe for operational use that is used to convey flows;

(g) "**Casing Pipe**" means a permanent pipe installed by MTBM methods which serves as a casing or secondary pipe around a smaller diameter carrier pipe;

(h) "**CLSM**" means Controlled Low Strength Material;

(i) "**Contractor's Engineer**" means a Professional Engineer, registered in the Province of Manitoba and experienced in the design of microtunnelling applications, construction shafts for microtunnelling applications, pipe for microtunnelling applications, and/or other aspects of the Work and hired by the Contractor to complete design work required to complete the Work and as specified herein;

(j) "**CSA**" means Canadian Standards Association;

(k) "**Fibreglass Pipe**" (FRP) means tubular product containing glass fiber reinforcements embedded in or surrounded by cured thermosetting resin. The composite structure may contain aggregate, granular or platelet fillers, thixotropic agents, pigments, or dyes;

(l) "**Geotechnical Data Report**" (GDR) means a document containing the results of geotechnical investigations carried out on the project site;

(m) "**Geotechnical Baseline Report**" (GBR) means a single source contract document containing measurable contractual descriptions of the geotechnical conditions to be anticipated or to be assumed to be anticipated during construction;

(n) "**Grout Port**" means a port located within the carrier pipe or steel lagging, fitted with a one-way valve, for injection of grout into the annular space between the lagging and the ground or between the carrier pipe and the excavation. Pipe plugs are inserted after grouting is completed;

(o) "**HDPE**" means high density polyethylene

(p) "**Intermediate Jacking Station**" (IJS) means a fabricated steel cylinder fitted with hydraulic jacks, which is incorporated into a pipeline between two specially fabricated pipe segments. Its function is to provide additional thrust in order to overcome skin friction and distribute the jacking forces over the pipe string on long drives;

(q) "**Jacking Record**" means a manually or automatically recorded report that contains information on tunnelling operations as defined herein;

(r) "**Low-Density Cellular Concrete**" (Cellular Concrete) means a lightweight cementitious material that contains stable air or gas cells uniformly distributed throughout the mixture;

(s) "**Microtunnelling**" means a **trenchless** pipeline installation method utilizing a pipe jacking system to advance a continuous pipe string and remote controlled MTBM through in situ soil and rock to provide continuous support for the excavated face and tunnel bore;

(t) "**Micro Tunnel Boring Machine**" (MTBM) means a steerable tunnelling machine that **achieves** soil excavation by means of a rotating cutter-wheel. The MTBM is advanced by

hydraulic jacking of a continuous pipe string behind the machine from the launching shaft. Excavated soil particles are returned to the surface via a pressurized slurry or belt conveyor system;

(u) "**Payment Certification**" means the Contract Administrator's statement of the sums certified to be paid by the City to the Contractor with reference to its interim and final progress estimates and/or the Contractor's Proper Invoice;

(v) "**Proper Invoice**" means the definition within *The Builders' Liens Act*, R.S.M. 1987, c. B91 and any subsequent amendments thereto, and also includes the criteria to be included in an invoice, as set out in the Measurement and Payment provisions of the Contract;

(w) "**Radial Overcut**" means the radial overcut is determined as the difference between the maximum diameter created by the cutting teeth or overcut band on the TBM (whichever is greater) and the outer diameter of the tail shield, divided by two;

(x) "**Settlement Point**" means a point with elevation and spatial location established by survey prior to construction. The point is re-surveyed periodically to monitor ground movements. The point may be a nail, pin, subsurface settlement rod, borehole extensometer, or other device that can be readily located and surveyed;

(y) "**Subsurface Monitoring Point**" (SSM) means a cased borehole settlement monitoring point located above the tunnel crown used for detecting settlement between the location of the settlement point and the tunnel excavation. This device serves as a simple borehole extensometer;

(z) "**Surface Monitoring Point**" (SMP) means monitoring points established to measure elevation of the ground surface;

(aa) "**Supply Chain Disruption"** means an inability by the Contractor to obtain goods or services from third parties necessary to perform the Work of the Contract within the schedule specified therein, despite the Contractor making all reasonable commercial efforts to procure same. Contractors are advised that increased costs do not, in and of themselves, amount to a Supply Chain Disruption;

(bb) "**The Builders' Liens Act**" or "**the BLA**" means *The Builders' Liens Act*, R.S.M. 1987, c. B91 and any subsequent amendments thereto'

(cc) "**Tunnel Face**" means the vertical (or near vertical) soil face at the end of the tunnel heading.

D7. CONTRACT ADMINISTRATOR

D7.1 The Contract Administrator is AECOM Canada ULC, represented by:

Matt Krentz, C.E.T.
Municipal Technologist

Telephone No. 204 346 4226
Email Address matthew.krentz@aecom.com

D7.2 At the pre-construction meeting, Mr. Krentz will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D8. CONTRACTOR'S SUPERVISOR

D8.1 At the pre-construction meeting, the Contractor shall identify their designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D9. ACCESSIBLE CUSTOMER SERVICE REQUIREMENTS

D9.1 The Accessibility for Manitobans Act (AMA) imposes obligations on The City of Winnipeg to provide accessible customer service to all persons in accordance with the Customer Service

Standard Regulation ("CSSR") to ensure inclusive access and participation for all people who live, work or visit Winnipeg regardless of their abilities.

D9.1.1 The Contractor agrees to comply with the accessible customer service obligations under the CSSR and further agrees that when providing the Goods or Services or otherwise acting on the City of Winnipeg's behalf, shall comply with all obligations under the AMA applicable to public sector bodies.

D9.1.2 The accessible customer service obligations include, but are not limited to:

(a) providing barrier-free access to goods and services;

(b) providing reasonable accommodations;

(c) reasonably accommodating assistive devices, support persons, and support animals;

(d) providing accessibility features e.g. ramps, wide aisles, accessible washrooms, power doors and elevators;

(e) inform the public when accessibility features are not available;

(f) providing a mechanism or process for receiving and responding to public feedback on the accessibility of all goods and services; and

(g) providing adequate training of staff and documentation of same.

D10. SUPPLIER CODE OF CONDUCT

D10.1 The Contractor has reviewed and understands the City's Supplier Code of Conduct. This document is located at: https://www.winnipeg.ca/media/4891

D10.2 The Contractor agrees to comply with the Supplier Code of Conduct as it may be amended or replaced from time to time. The Contractor is responsible for periodically checking the above link for updates to the Supplier Code of Conduct. Contract signature on Form A: Bid/Proposal from the Contractor signifies agreement to the Supplier Code of Conduct which comes into effect once the Contract starts.

D10.3 If there is a conflict between the Contract and the Supplier Code of Conduct – the Contract will prevail.

D11. UNFAIR LABOUR PRACTICES

D11.1 Further to C3.2, the Contractor declares that in bidding for the Work and in entering into this Contract, the Contractor and any proposed Subcontractor(s) conduct their respective business in accordance with established international codes embodied in United Nations Universal Declaration of Human Rights (UDHR) https://www.un.org/en/about-us/universal-declaration-of-human-rights International Labour Organization (ILO) https://www.ilo.org/global/lang--en/index.htm conventions as ratified by Canada.

D11.2 The City of Winnipeg is committed and requires its Contractors and their Subcontractors, to be committed to upholding and promoting international human and labour rights, including fundamental principles and rights at work covered by ILO eight (8) fundamental conventions and the United Nations Universal Declaration of Human Rights which includes child and forced labour.

D11.3 Upon request from the Contract Administrator, the Contractor shall provide disclosure of the sources (by company and country) of the raw materials used in the Work and a description of the manufacturing environment or processes (labour unions, minimum wages, safety, etc.).

D11.4 Failure to provide the evidence required under D11.3, may be determined to be an event of default in accordance with C18.

D11.5 In the event that the City, in its sole discretion, determines the Contractor to have violated the requirements of this section, it will be considered a fundamental breach of the Contract and the

Contractor shall pay to the City a sum specified by the Contract Administrator in writing ("Unfair Labour Practice Penalty"). Such a violation shall also be considered an Event of Default, and shall entitle the City to pursue all other remedies it is entitled to in connection with same pursuant to the Contract.

D11.5.1 The Unfair Labour Practice Penalty shall be such a sum as determined appropriate by the City, having due regard to the gravity of the Contractor's violation of the above requirements, any cost of obtaining replacement goods/ services or rectification of the breach, and the impact upon the City's reputation in the eyes of the public as a result of same.

D11.5.2 The Contractor shall pay the Unfair Labour Practice Penalty to the City within thirty (30) Calendar Days of receiving a demand for same in accordance with D11.5. The City may also hold back the amount of the Unfair Labour Practice Penalty from payment for any amount it owes the Contractor.

D11.5.3 The obligations and rights conveyed by this clause survive the expiry or termination of this Contract, and may be exercised by the City following the performance of the Work, should the City determine, that a violation by the Contractor of the above clauses has occurred following same. In no instance shall the Unfair Labour Practice Penalty exceed the total of twice the Contract value.

D12. FURNISHING OF DOCUMENTS

D12.1 Upon award of the Contract, the Contractor will be provided with 'issued for construction' Contract Documents electronically, including Drawings in PDF formal only.

SUBMISSIONS

D13. AUTHORITY TO CARRY ON BUSINESS

D13.1 The Contractor shall be in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba, or if the Contractor does not carry on business in Manitoba, in the jurisdiction where the Contractor does carry on business, throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

D14. SAFE WORK PLAN

D14.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract Documents, if applicable.

D14.2 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, Purchasing Division website at http://www.winnipeg.ca/matmgt/Safety/default.stm

D14.3 Notwithstanding B13.4 at any time during the term of the Contract, the City may, at their sole discretion and acting reasonably, require an updated COR Certificate or Annual Letter of good Standing. A Contractor, who fails to provide a satisfactory COR Certificate or Annual Letter of good Standing, will not be permitted to continue to perform any Work.

D15. INSURANCE

D15.1 The City shall provide and maintain the following owner-controlled insurance coverage to remain in place at all times during the performance of the Work:

(a) wrap up liability insurance, in the amount of at least ten million dollars ($10,000,000.00) inclusive. The insured parties shall include the City, Contractor and all subcontractor whether named or unnamed in the policy and all others having an insurable interest in the Work. Manitoba, its ministers, officers, employees and agents to be added as additional insureds. Wrap up liability insurance to include but not limited to

(i) products and completed operations

(ii) blanket contractual liability

(iii) unlicensed motor vehicle liability,

(iv) sudden and accidental pollution liability(

(v) blasting, tunneling or the removal or weakening of support of any land, whether such support be natural or otherwise, (

(vi) no XCU exclusion,

(vii) cross liability clauses

(viii) non-owned automobile liability

(ix) owners and contractors protective

(b) Wrap up liability insurance shall be maintained from the date of the commencement of the Work until the date of Total Performance of the Work and shall include an additional twenty-four months completed operations coverage that will take affect after Total Performance.

(c) The City reserves the right to add, delete, revise and redefine insurance requirements and deductibles at any time, at its sole discretion, or as necessitated by the placement, extensions/renewals of the insurance policy, during the term of the Project.

(d) Deductibles under the policy shall not exceed $50,000 maximum of any one loss and shall be borne by the Contractor.

D15.2 The Contractor shall provide and maintain the following insurance coverage:

(a) commercial general liability insurance, in the amount of at least five million dollars ($5,000,000.00) inclusive, with The City of Winnipeg and Manitoba its ministers officers employees and agents to be added as additional insureds, with a cross-liability clause, such liability policy to also contain contractual liability, unlicensed motor vehicle liability, non-owned automobile liability, broad form property damage cover and products and completed operations and shall not contain any XCU exclusions or limitations and to remain in place at all times during the performance of the Work and throughout the warranty period;

(b) Automobile Liability Insurance covering all motor vehicles, owned and operated and used or to be used by the Contractor directly or indirectly in the performance of the Work. The Limit of Liability shall not be less than $2,000,000 inclusive for loss or damage including personal injuries and death resulting from any one accident or occurrence.

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

(d) all risks property insurance for all equipment, machinery, portable offices, portable toilets including any tunnelling and trenchless sewer installation equipment, and tools used on the Project that may be owned, rented, leased or borrowed.

(e) Contractors pollution liability insurance (CPL) in the amount of no less than one million dollars ($1,000,000) per occurrence and two million dollars ($2,000,000) in the aggregate insuring against claims for third party injury and property damage and including clean up costs and transported cargo as a result of pollution conditions arising suddenly or gradually from the Contractors operations and completed operations. Such policy shall name the City as an additional insured and remain in place throughout the warranty period.

D15.3 Deductibles shall be borne by the Contractor.

D15.4 All policies shall be taken out with insurers licensed to carry on business in the Province of Manitoba.

D15.5 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in C4.1 for the return of the executed Contract Documents, as applicable.

D15.6 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least thirty (30) Calendar Days prior written notice to the Contract Administrator.

D15.7 The Contractor shall be required to cooperate with the City and provide their project experience and project claims history and any other information necessary for the City to obtain the owner-controlled project insurance as outlined in D15.1(a) within five(5) business days after request.

D16. CONTRACT SECURITY

D16.1 The Contractor shall provide and maintain the performance bond and the labour and material payment bond 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 amount of fifty percent (50%) of the Contract Price; and

(b) labour and material payment bond of a company registered to conduct the business of a surety in Manitoba, in an amount equal to fifty percent (50%) of the Contract Price.

D16.1.1 Bonds are available at:

(a) Performance Bond https://www.winnipeg.ca//media/4928/

(i) Performance Bond – Schedule A - Form of Notice https://www.winnipeg.ca/media/4831/

(ii) Performance Bond – Schedule B – Surety's Acknowledgement https://www.winnipeg.ca/media/4832/

(iii) Performance Bond – Schedule C – Surety's Position https://www.winnipeg.ca/media/4833/

(b) Labour & Material Payment Bond https://www.winnipeg.ca//media/4930/

(i) L&M Bond – Schedule A – Notice of Claim https://www.winnipeg.ca/media/4834/

(ii) L&M Bond – Schedule B – Acknowledgement of a Notice https://www.winnipeg.ca/media/4835/

(iii) L&M Bond – Schedule C – Surety's Position https://www.winnipeg.ca/media/4836/

D16.1.2 Where the contract security is a performance bond, it may be submitted in hard copy or digital format. If submitted in digital format the contract security must meet the following criteria:

(a) the version submitted by the Contractor must have valid digital signatures and seals;

(b) the version submitted by the Contractor must be verifiable by the City with respect to the totality and wholeness of the bond form, including: the content; all digital signatures and digital seals; with the surety company, or an approved verification service provider of the surety company.

(c) the version submitted must be viewable, printable and storable in standard electronic file formats compatible with the City, and in a single file. Allowable formats include pdf.

(d) the verification may be conducted by the City immediately or at any time during the life of the bond and at the discretion of the City with no requirement for passwords or fees.

(e) the results of the verification must provide a clear, immediate and printable indication of pass or fail regarding D16.1(b).

D16.1.3 Digital bonds failing the verification process will not be considered to be valid and may be determined to be an event of default in accordance with C18.1. If a digital bond fails the verification process, the Contractor may provide a replacement bond (in hard copy or digital format) within seven (7) Calendar Days of the City's request or within such greater period of time as the City in their discretion, exercised reasonably, allows.

D16.1.4 Digital bonds passing the verification process will be treated as original and authentic.

D16.2 The Contractor shall provide the Contract Administrator identified in D7 with the required performance and labour and material payment bonds within seven (7) Calendar Days of notification of the award of the Contract by way of an award letter and prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract Documents, if applicable.

D16.3 The Contractor shall, as soon as practicable after entering into a contract with a Subcontractor:

(a) give the Subcontractor written notice of the existence of the labour and material payment bond inD16.1(b); and

(b) post a notice of the bond and/or a copy of that bond in a conspicuous location at the Site of the Work.

D17. SUBCONTRACTOR LIST

D17.1 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 the General Conditions for the return of the executed Contract Documents, if applicable.

D18. EQUIPMENT LIST

D18.1 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 C4.1 for the return of the executed Contract Documents, if applicable.

D19. DETAILED WORK SCHEDULE

D19.1 The Contractor shall provide the Contract Administrator with a detailed work schedule at least ten (10) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D19.2 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.

D19.3 Further to D19.2(a), the C.P.M. schedule shall clearly identify the start and completion dates of all of the following activities/tasks making up the Work as well as showing those activities/tasks on the critical path:

(a) Commencement date;

(b) Mobilization to site;

(c) Site preparation;

(d) Tunnel shaft construction (by location):

(i) Excavation and shoring;
(ii) Working slab;
(iii) Microtunnelling equipment setup;

(e) Microtunnelling;

(f) Carrier pipe installation;

(g) Construction of chambers (by location);

(h) Tie-in to existing sewer (by location);

(i) Installation of chamber piping (by location);

(j) Installation of chamber appurtenances (by location);

(k) Lining and reparation of existing outfall pipe;

(l) Additional critical dates;

(m) Critical Stage 1;

(n) Substantial Performance;

(o) Site grading;

(p) Site restoration; and,

(q) Total Performance.

D20. REQUIREMENTS FOR SITE ACCESSIBILITY PLAN

D20.1 The Contractor shall provide the Contract Administrator with an Accessibility Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract Documents, if applicable.

D20.2 The Accessibility Plan shall demonstrate how the Contractor will accommodate the safe passage of pedestrians and cyclists in accordance with the Manual of Temporary Traffic Control, the Contract Drawings, Staging Plans, and Streets By-Law No. 1481/77 at all times for the duration of the Construction. Unless noted in the Contract, the Accessibility Plan must include a written plan for the following:

(a) How the Contractor will maintain at least one crossing in each direction for each intersection (one north/south crosswalk and one east/west crosswalk).

(b) How the Contractor will maintain access to bus stops within the site.

(c) How the Contractor will maintain access to pedestrian corridors and half signals.

(d) How the Contractor will maintain cycling facilities.

(e) How the Contractor will maintain access to residents and businesses unless otherwise noted in the Contract.

(f) Any required detour signage at adjacent crossings to facilitate sidewalk or active transportation pathway closures.

D20.3 The Accessibility Plan may also include figures, sketches, or drawings to demonstrate the proposed plan.

D20.4 The Accessibility Plan shall include written details on how the Contractor intends to review, maintain, and document all items related to the Accessibility Plan on-site during Construction, including, but not limited to:

(a) Signage

(b) Temporary Ramping

(c) Transit Stops

(d) Detour Signage

D20.5 At minimum, the Contractor shall review the site conditions on a daily basis to ensure that all features related to the Accessibility Plan are in place. The site review is intended to correct deficiencies as a result of unforeseen events such as wind, traffic, or the general public. Deficiencies that are direct result of the Contractors actions must be corrected immediately.

D20.6 Any changes to the Accessibility Plan must be approved by the Contract Administrator.

D20.7 Upon request from the Contract Administrator, the Contractor shall provide records demonstrating that the site has been maintained.

D20.8 Deficiencies as a direct result of actions by the Contractor that are not immediately corrected and/or failure to produce records that demonstrate that the site was maintained in compliance with the Accessibility Plan may result in a pay adjustment via the monthly Progress Payment. The rate of pay adjustment will be as per the following schedule:

(a) First Offence – A warning will be issued and documented in the weekly or bi-weekly site meeting.

(b) Second Offence – A field instruction to immediately correct the site will be issued by the Contract Administrator.

D20.9 Third and subsequent Offences – A pay reduction will be issued in the amount of $250.00 per instance and per day.

SCHEDULE OF WORK

D21. COMMENCEMENT

D21.1 The Contractor shall not commence any Work until they are in receipt of an award letter from the Award Authority authorizing the commencement of the Work.

D21.2 The Contractor shall not commence any Work on the Site until:

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

(i) evidence of authority to carry on business specified in D13;

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

(iii) the Safe Work Plan specified in D14;

(iv) evidence of the insurance specified in D15;

(v) the contract security specified in D16;

(vi) the Subcontractor list specified in D17;

(vii) the detailed work schedule specified in D19

(viii) the Requirements for Site Accessibility Plan specified in D20;

(ix) the Equipment List specified in D18; and

(x) the direct deposit application form specified in D36.

(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.

D21.3 The City intends to award this Contract by July 4, 2025.

D21.3.1 If the actual date of award is later than the intended date, the dates specified for Critical Stages, Substantial Performance, and Total Performance will be adjusted by the difference between the aforementioned intended and actual dates.

D22. WORK BY OTHERS

D22.1 Further to C6.25, the Contractor’s attention is directed to the fact that other Contractors, the personnel of Utilities and the staff of the City may be working within the project limit, approach roadway, adjacent roadways or right-of-way. The activities of these agencies may coincide with

the Contractors execution of Work and it will be the Contractor's responsibility to cooperate to the fullest extent with other personnel working in the area, and such cooperation is an obligation of the Contractor under the terms of Contract.

D22.2 Work by others on or near the Site will include but not necessarily be limited to:

(a) Tender 175-2024 Installation, Operation and Maintenance of WWS Bypass at D'Arcy Pumping Station – Nelson River Construction;

D22.2.1 Further to D22.1 the Contractor shall cooperate and coordinate all activities with all parties performing required Work by Others identified in D22.1 and accommodate the necessary area on Site required for the Work by Others to complete the Work

D22.2.2 Operation and maintenance of D'Arcy emergency WWS force main and bypass from the D'Arcy Pumping Station crossing the Abinojii Mikanah eastbound bridge and terminating in WWS manhole east of the Red River. Maintain access at all times to the D'Arcy WWS Pumping Station for access, fueling, and maintenance of the temporary bypass systems.

D23. HOURS OF WORK

D23.1 Contactor is permitted to conduct 24 hour operations when Microtunnelling.

(a) Hours of work listed in Clause C1.1(tt) are amended by this clause when working on the specified Work activities.

(b) Work occurring during the prohibited time listed in Clause 69(1) of City Neighborhood Livability By-Law 1/2008 will be exempt during 24 hour operation on the condition that the Contractor has adhered to the Noise Management requirement listed in E21.

D24. CRITICAL STAGES

D24.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:

(a) Critical Stage 1

(i) Commissioning of waste water flows through the new Discharge Chamber, 1350 mm Upstream Gravity Sewer, Upstream Siphon Chamber, New Siphon Crossing, Downstream Siphon Chamber, 1350 mm Downstream Gravity Sewer and New St. Vital Trunk Connection to the extent that allows for the removal the Emergency By-Pass by May 15, 2026.

D25. SUBSTANTIAL PERFORMANCE

D25.1 The Contractor shall achieve Substantial Performance by June 15, 2026.

D25.2 When the Contractor considers the Work to be substantially performed, the Contractor shall arrange, attend and assist in the inspection of the Work with the Contract Administrator for purposes of verifying Substantial Performance. Any defects or deficiencies in the Work noted during that inspection shall be remedied by the Contractor at the earliest possible instance and the Contract Administrator notified so that the Work can be reinspected.

D25.3 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.

D26. TOTAL PERFORMANCE

D26.1 The Contractor shall achieve Total Performance by July 15, 2026.

D26.2 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.

D26.3 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.

D27. LIQUIDATED DAMAGES

D27.1 If the Contractor fails to achieve, Critical Stages, 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 Calendar Day for each and every Calendar following the days fixed herein for same during which such failure continues:

(a) Critical Stage 1 – Six Thousand Five Hundred dollars ($6,500.00);

(b) Substantial Performance - Two Thousand Two Hundred dollars ($2,200.00);

(c) Total Performance - One Thousand One Hundred dollars ($1,100.00).

D27.2 The amounts specified for liquidated damages in D27.1 are based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve, Critical Stages, Substantial Performance or Total Performance by the days fixed herein for same.

D27.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D28. SUPPLY CHAIN DISRUPTION SCHEDULE DELAYS

D28.1 The City acknowledges that the schedule for this Contract may be impacted by the Supply Chain Disruption. Commencement and progress of the Work shall be performed by the Contractor with due consideration to the delivery requirements and schedule identified in the Contract in close consultation with the Contract Administrator.

D28.2 If the Contractor is delayed in the performance of the Work by reason of the Supply Chain Disruption, the Work schedule may be adjusted by a period of time equal to the time lost due to such delay and costs related to such delay will be determined as identified herein.

D28.3 A minimum of seven (7) Calendar Days prior to the commencement of Work, the Contractor shall declare whether a Supply Chain Disruption will affect the start date. The Contractor shall provide sufficient evidence that the delay is directly related to a Supply Chain Disruption, including but not limited to ordering of Material or Goods, production and/or manufacturing schedules or availability of staff as appropriate.

D28.4 For any delay related to Supply Chain Disruption and identified after Work has commenced, the Contractor shall within seven (7) Calendar Days of becoming aware of the anticipated delay declare the additional delay and shall provide sufficient evidence as indicated in D28.3. Failure to provide this notice will result in no additional time delays being considered by the City.

D28.5 The Work schedule, including the durations identified in D24 to D26 where applicable, will be adjusted to reflect delays accepted by the Contract Administrator. No additional payment will be made for adjustment of schedules except where seasonal work, not previously identified in the Contract, is carried over to the following construction season.

D28.6 Where Work not previously identified is being carried over solely as a result of delays related to Supply Chain Disruption, as confirmed by the Contract Administrator, the cost of temporary works to maintain the Work in a safe manner until Work recommences, will be considered by the Contract Administrator. Where the Work is carried over only partially due to Supply Chain Disruption, a partial consideration of the cost of temporary works will be considered by the Contract Administrator.

D28.7 Any time or cost implications as a result of Supply Chain Disruption and in accordance with the above, as confirmed by the Contract Administrator, shall be documented in accordance with C7.

D29. SCHEDULED MAINTENANCE

D29.1 The Contractor shall perform the following scheduled maintenance in the manner and within the time periods required by the Specifications:

(a) Seeding and/or Sodding as specified in CW3510 and Specifications included herein;

(b) Watering and maintenance of new vegetation until established.

D29.2 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

D30. JOB MEETINGS

D30.1 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.

D30.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever they deem it necessary.

D31. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D31.1 Further to C6.26, 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).

D31.2 The Emergency Bypass Contractor shall be the Prime Contractor for the area delineated for Bypass Pump, Generators and within the D'Arcy Lift Station.

D31.3 The laydown area as shown south of the D'Arcy Lift Station will be made available and become the responsibility the Prime Contractor after December 15, 2025, as shown on the Drawings.

D32. THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA) – QUALIFICATIONS

D32.1 Further to B13.4, the Contractor/Subcontractor must, throughout the term of the Contract, have a Workplace Safety and Health Program meeting the requirements of The Workplace Safety and Health Act (Manitoba). At any time during the term of the Contract, the City may, at their sole discretion and acting reasonably, require updated proof of compliance, as set out in B13.4.

D33. WORK UNDERNEATH AND IN THE VICINITY OF HYDRO POWER INFRASTRUCTURE

D33.1 The Contractor is responsible for notifying Manitoba Hydro in advance of Work in the vicinity and underneath Hydro infrastructure (e.g. overhead transmission lines). The Contractor shall follow all Manitoba Hydro requirements for safe working distances and clearances from Hydro infrastructure including but not limited to overhead electrical lines.

D33.2 Manitoba Hydro requires a minimum vertical clearance from their overhead electrical lines as follows:

(a) Minimum 10 feet from overhead distribution lines;

(b) Minimum 15 feet from overhead transmission lines; and

(c) Minimum 20 feet from high voltage transmission lines.

D34. GEOTECHNICAL BASELINE REPORT AND GEOTECHNICAL DATA REPORT

D34.1 The primary purpose of the GBR is to establish a contractual understanding of the geotechnical conditions anticipated to be encountered during construction of the project. The GBR sets baselines for geotechnical conditions and material behaviour anticipated to be encountered during construction in order to provide a basis for bidding and assist in resolution of disputes that may arise over subsurface conditions. Secondarily, the GBR:

(a) Presents the geotechnical and construction conditions that formed the basis of design.

(b) Identifies important considerations, key project constraints, and select requirements that must be addressed by the Contractor during bid preparation and construction

(c) Provides information to assist the Contractor in evaluating requirements for excavating and supporting the ground.

(d) Provides guidance to the Contract Administrator in administering the contract and monitoring Contractor performance.

D34.2 The GBR provides the basis for identifying geotechnical and geologic conditions that qualify as a “substantial difference in the nature of the surface or subsurface conditions”, as defined herein. The geotechnical baseline conditions (baseline) contained within the GBR are not necessarily geotechnical fact. The baseline was developed using judgment to interpolate between borings and extrapolate beyond the boring logs and laboratory test data. The judgment applied in the interpolations and extrapolations reflects the view of the author of the report in describing the baseline. Bidders should use the baseline subsurface conditions and the surface conditions which can be observed during a site visit as the basis for bids. It should be noted that the project design was based on assumed construction methods and levels of workmanship. The behavior of the geologic materials present in the surface and subsurface excavations will be influenced by the Contractor’s selected equipment, means, and methods.

D34.3 The GBR was developed for the sole purpose of the Microtunneling portion of the Work, inclusive of shaft construction and tunnelling of the 2100 mm reinforced concrete pipe (RCP) crossing the Red River.

D34.4 The GDR provides a summary of results for the geotechnical testing undertaken along the pipe alignment through the Site.

D34.5 Bidders should have a geotechnical engineer and/or engineering geologist review and explain the information presented in the GBR and GDR to assure a complete understanding of the reported information as a basis for submitting a Bid. Additional documents used to develop the GBR are listed in the References section of the GBR.

(a) The GBR was developed in part from the GDR. The technical data contained within the GDR upon which Contractor may rely are: the boring method, the locations and logs of the borings, the levels of subsurface water (if any), laboratory test methods and results, and similar factual data. Bore hole information represents subsurface characteristics to the extent indicated, only for the point location of the bore hole and, with regard to the level of subsurface water (if any), only at the time the boring was made. Contractor is not entitled to rely upon other technical data.

D34.6 Risks associated with subsurface conditions consistent with, or less adverse than the baseline conditions are allocated to the Contractor. Those risks associated with subsurface conditions more adverse than the baseline condition are accepted by the City. The provision of a baseline condition in the Contract is not a warranty that the baseline condition will be encountered. The

baseline condition is the contractual standard that the City and the Contractor will agree to use when interpreting D37.

D34.7 The City accepts the risks for subsurface conditions that are less favorable than the stated baseline conditions for the Microtunnelling and associated shaft Work. The City will negotiate with the Contractor for additional reasonable compensation to the Contractor if these three conditions exist:

(a) The actual subsurface conditions encountered are more adverse than the baseline conditions.

(b) The Contractor can document that the subsurface conditions are more adverse than those described in the baseline and that the conditions materially and significantly increased the cost and/or time required to complete the work.

(c) The Contractor has made diligent efforts to complete the work described in the Contract Documents, including any changes to methods, equipment, labor, and materials made necessary by the adverse conditions using the most cost effective means.

If all of the foregoing conditions are satisfactorily met, additional compensation and schedule will be negotiated, based on the provisions described in D37.

INVOICES & MEASUREMENT AND PAYMENT

D35. MEASUREMENT AND PAYMENT

D35.1 C12.2 is deleted and replaced with the following:

C12.2 The amounts to be paid by the City to the Contractor shall be as set out in the Payment Certification. In the event the Payment Certification does not align with the Contractor's Proper Invoice and payment by the City to the Contractor is not made, or not going to be made, for the invoiced amount within 28 Calendar Days of receipt of the Proper Invoice, the City will issue a notice of non-payment to the Contractor in accordance with the BLA.

C12.2.1 For unit price Contracts, such sums shall be determined by the Contract Administrator upon the basis of the unit prices for the various classes of the Work stated on Form B: Prices. The total amount to be paid to the Contractor for the Work will be the amount arrived at by measuring the amount of each class of the Work listed on Form B: Prices and performed in accordance with the Contract, and pricing the same, in accordance with the unit prices stated thereon.

C12.2.2 For lump sum Contracts, such sums shall be determined by the Contract Administrator upon the basis of the lump sum price stated on Form B: Prices, if applicable, but in any event the lump sum price broken down into the percentage completed for each portion of the Work, commonly referred to as detailed prices.

D35.2 C12.7 to C12.15 are deleted and replaced with the following:

C12.7 By the seventh (7) Calendar Day after the end of each month, the Contract Administrator shall issue to the Contractor a progress estimate indicating its opinion of the quantity and value of Work performed during the previous month. The Contractor may use the progress estimate to form part of its Proper Invoice as support of the type and quantity of Work performed. In the event the Contractor choses to produce its own documentation of the type and quantity of Work performed to form part of its Proper Invoice, the content shall be in accordance with C12.2 and the format of such documentation should follow that of a typical progress estimate, including all evidence and records of measurement that the Contract Administrator would require to certify payment. In either event the Contractor shall include such supporting documentation as part of its invoice.

C12.8 If the Contractor agrees with the progress estimate provided by the Contract Administrator it should indicate that on its Proper Invoice. If the Contractor does not agree with the progress estimate provided by the Contract Administrator it should attempt to reconcile the discrepancy, which could result in a revised progress estimate to be provided by the Contract Administrator or a revised invoice by the Contractor, so that the progress estimate and the Proper Invoice align. In the event that the discrepancy is not reconciled then the Contractor should detail the items within the progress estimate that it disagrees with in order that the value on the Proper Invoice aligns with and is supported by the progress estimate with noted discrepancies.

C12.9 Any payment made by the City to the Contractor on account of a Proper Invoice shall be less any holdback required to be made by The Builders' Liens Act, and such holdbacks or other amounts which the City is entitled to withhold pursuant to the Contract.

C12.10 If in the Contractor's opinion the Work performed during the previous month is minimal or does not warrant an invoice, the Contractor is permitted to not submit an invoice on the condition that the Contractor advises the Contractor Administrator in writing.

C12.11 Unless agreed to by the Contract Administrator, in writing, on an exception basis, the Contractor shall not submit invoices more frequently than monthly.

C12.12 Any reference to payment submittals or payment processes in the NMS Sections of the Contract are deleted and replaced with the payment submittals and payment processes within Section C12 of the General Conditions, as amended by the Supplemental Conditions.

FINAL PAYMENT

C12.13 The Contractor shall indicate on its invoice if it is the final invoice for Work performed under the Contract. Payment Certification, in response to receipt of the final Proper Invoice by the Contractor, shall be subject to the following conditions:

(a) issuance by the Contract Administrator of a certificate of Total Performance;

(b) receipt by the City of a certificate from the Workers Compensation Board stating that full payment has been made to the Board with respect to all assessments owing.

C12.14 Payment on account of the holdback made by the City pursuant to The Builders' Liens Act, shall be paid to the Contractor when the time for filing liens or trust claims has elapsed, unless the City is in receipt of a lien or trust claim.

C12.15 Neither the issuance of a certificate of Total Performance nor the payment of the final Proper Invoice shall relieve the Contractor from their responsibilities either under C13 or as a result of any breach of the Contract by the Contractor including, but not limited to, defective or deficient Work appearing after Total Performance, nor shall it conclude or prejudice any of the powers of the Contract Administrator or the Chief Administrative Officer hereunder.

C12.16 Subject to C12.17, acceptance by the Contractor of payment on account of the final Proper Invoice shall constitute a waiver and release by them of all claims against the City whether for payment for Work done, damages or otherwise arising out of the Contract.

C12.17 If the Contractor disputes a Payment Certification related to a notice of non-payment by the City to the Contractor in accordance with the BLA, the Contractor may appeal the determination of the Contract Administrator to the Chief Administrative Officer as provided for in C21. If prior to the appeal being concluded, the Contractor gives a notice of adjudication to the City pursuant to the BLA, the appeal process will be discontinued.

INVOICES

D35.3 Further to C12, the Contractor:

(a) shall submit invoices for Work performed during the previous calendar month in accordance with the instruction on the City's website at: https://www.winnipeg.ca/finance/corporate-accounts-payable.stm; and

(b) should copy the Contract Administrator on submission of its invoice.

D36. PAYMENT

D36.1 Further to C12, the City shall make payments to the Contractor by direct deposit to the Contractor's banking institution, and by no other means. Payments will not be made until the Contractor has made satisfactory direct deposit arrangements with the City. Direct deposit application forms are at https://winnipeg.ca/finance/files/Direct_Deposit_Form.pdf.

D36.2 Further to E14 no payment will be made for Cash Allowances other than as set out in E14.4.

D37. CHANGES IN WORK

D37.1 Amend C7.2.1(a) to include the following additional clauses:

(a) Contractor shall notify the Contract Administrator promptly in writing of any changes in geotechnical, geologic or material behaviour conditions that the Contractor considers more adverse than the GBR baseline conditions upon discovery and before they are disturbed, in any event no later than five (5) calendar days after discovery.

(b) No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under the Contract Documents.

(c) No claim by the Contractor related to shaft excavation or microtunnelling shall be allowed under Changes of Work provisions unless the Contractor investigates and demonstrates that such alleged conditions are materially different from those conditions identified in the Geotechnical Baseline Report and results in an increase in the Contractor's cost of and/or time required for performance of the Work.

(i) Contractor shall, within 30 calendar days after notification to the City that Contractor believes a material difference exists, provide the documentation, backup, justification, and compensation for the alleged impact to Contractor's cost of and/or time required for performance of the Work.

(ii) Any and all costs incurred by the Contractor for demonstrating that a material difference exists shall be borne by the Contractor unless the City agrees that the material difference does have a cost and/or time impact. If City agrees that there is a material difference that impacts Contractor's cost and/or time, payment for geologic investigation(s) and testing of the material difference will be paid for by the City.

(iii) Payment will be made by the City for reasonable and customary prices for geologic investigation(s) and testing. Contractor is encouraged to review geologic investigations and/or testing planned to demonstrate a material difference with the Contract Administrator prior to execution of the same. The City will be sole judge of what is reasonable and customary.

(d) The Contractor expressly agrees to maintain detailed daily labor, material, production, and equipment logs defining hours and costs for all periods of Contractor performance representing claimed differing site conditions.

(i) These logs shall fully separate bid Contract Work from claimed differing site condition work, and the Contractor shall provide these documents to the Contract Administrator for review. These daily logs shall constitute documentation of performance, and must be signed on a daily basis both by the Contractor and Contract Administrator. Said signatures do not mean acceptance of the claim or value of adjustment of Contract Price and/or Time but will serve to document the Contractor's use of labor, material, and equipment.

(ii) If Contract Administrator and City agree that there is a material difference that impacts Contractor's cost and/or time, payment for the material difference in labour, material, production and equipment will be paid for by the City based on reasonable and customary prices, using the methods defined in C7.4. Equipment rates will be established in accordance with the Daily Equipment Rate listed on the Form B and as defined in E15.

(iii) The failure of the Contractor to maintain said logs or to obtain signatures on the logs shall render the Contract Administrators daily records as definitive.

D38. FUEL PRICE ADJUSTMENT

D38.1 The Contract is subject to a fuel price adjustment which will be calculated monthly based on eligible Work completed utilizing the following mathematical formulas;

(a) where the price of fuel has increased - ((CFI/BFI)-1.15) x Q x FF; and

(b) where the price of fuel has decreased - ((CFI/BFI)-0.85) x Q x FF; where

(i) BFI = base fuel index

(ii) CFI = current fuel index

(iii) FF = fuel factor

(iv) Q = monetary value of Work applied in the calculation.

D38.1.1 Eligible Work will be determined in accordance with D38.5.

D38.1.2 The base fuel index (BFI) will be the retail price of fuel identified on the Submission Deadline based on latest published "Monthly average retail prices for gasoline and fuel by geography" for Winnipeg, published by Statistics Canada, Table 18-10-0001-01. The BFI is a blended rate based on 15% regular unleaded gasoline at self-service filling stations and 85% diesel fuel at self-service filling stations.

D38.1.3 The current fuel index (CFI) based on the above blended rate will be determined for each monthly progress estimate and applied on the following progress estimate as a change order once rates are published by Statistics Canada.

D38.1.4 A Fuel Factor (FF) rate of the monetary value of all eligible Work completed that month based on the Contract unit prices will be used to calculate the assumed apportioned cost of fuel.

D38.2 Fuel cost adjustments may result in additional payment to the Contractor or credit to the City within the Contract by way of a monthly change order.

D38.3 The fuel escalation or de-escalation adjustment will not be applied if the CFI is within ±15% of the BFI.

D38.4 Fuel escalation adjustments will not be considered beyond the Substantial Performance/Critical Stages except where those dates/Working Days are adjusted by change order. Fuel de-escalation adjustments will apply for Work that extends beyond the dates/Working Days specified for Substantial Performance/Critical Stages.

D38.5 The Fuel Factor (FF) rates will be set as follows:

(a) The Fuel Factor rate shall be set at 2.7% of the monetary value of all Work based on unit prices except for the portions of the Contract identified below;

WARRANTY

D39. WARRANTY

D39.1 Notwithstanding C13.2, the Contract Administrator may permit the warranty period for a portion or portions of the Work to begin prior to the date of Substantial Performance if:

(a) a portion of the Work cannot be completed because of unseasonable weather or other conditions reasonably beyond the control of the Contractor but that portion does not prevent the balance of the Work from being put to its intended use.

D39.1.1 In such case, the date specified by the Contract Administrator for the warranty period to begin shall be substituted for the date specified in C13.2 for the warranty period to begin.

DISPUTE RESOLUTION

D40. DISPUTE RESOLUTION

D40.1 If the Contractor disagrees with any opinion, determination, or decision of the Contract Administrator, the Contractor shall act in accordance with the Contract Administrator's opinion, determination, or decision unless and until same is modified by the process followed by the parties pursuant to D40.

D40.2 The entire text of C21.4 is deleted, and amended to read: "Intentionally Deleted"

D40.3 The entire text of C21.5 is deleted, and amended to read:

(a) If Legal Services has determined that the Disputed Matter may proceed in the Appeal Process, the Contractor must, within ten (10) Business Days of the date of the Legal Services Response Letter, submit their written Appeal Form, in the manner and format set out on the City's Purchasing Website, to the Chief Administrative Officer, and to the Contract Administrator. The Contractor may not raise any other disputes other than the Disputed Matter in their Appeal Form.

D40.4 Further to C21, prior to the Contract Administrator's issuance of a Final Determination, the following informal dispute resolution process shall be followed where the Contractor disagrees with any opinion, determination, or decision of the Contract Administrator ("Dispute"):

(a) In the event of a Dispute, attempts shall be made by the Contract Administrator and the Contractor's equivalent representative to resolve Disputes within the normal course of project dealings between the Contract Administrator and the Contractor's equivalent representative.

(b) Disputes which in the reasonable opinion of the Contract Administrator or the Contractor's equivalent representative cannot be resolved within the normal course of project dealings as described above shall be referred to a without prejudice escalating negotiation process consisting of, at a minimum, the position levels as shown below and the equivalent Contractor representative levels:

(i) The Contract Administrator;

(ii) Supervisory level between the Contract Administrator and applicable Department Head;

(iii) Department Head.

D40.5 Names and positions of Contractor representatives equivalent to the above City position levels shall be determined by the Contractor and communicated to the City at the pre-commencement or kick off meeting.

D40.6 As these negotiations are not an adjudicative hearing, neither party may have legal counsel present during the negotiations.

D40.7 Both the City and the Contractor agree to make all reasonable efforts to conduct the above escalating negotiation process within twenty (20) Business Days, unless both parties agree, in writing, to extend that period of time.

D40.8 If the Dispute is not resolved to the City and Contractor's mutual satisfaction after discussions have occurred at the final escalated level as described above, or the time period set out in D40.7, as extended if applicable, has elapsed, the Contract Administrator will issue a Final

Determination as defined in C1.1(v), at which point the parties will be governed by the Dispute Resolution process set out in C21.

INDEMNITY

D41. INDEMNITY

D41.1 Indemnity shall be as stated in C17.

D41.2 Notwithstanding C17.1, the Contractor shall save harmless and indemnify the City in the amount of twice the Contract Price or five million dollars ($5,000,000), whichever is greater, against all costs, damages or expenses arising from actions, claims, demands and proceedings, by whomsoever brought, made or taken as a result of negligent acts or negligent omissions of the Contractor, their Subcontractors, employees or agents in the performance or purported performance of the Work, and more particularly from:

(a) accidental injury to or death of any person whether retained by or in the employ of the contractor or not, arising directly or indirectly by reason of the performance of the Work, or by reason of any trespass on or damage to property;

(b) damage to any property owned in whole or in part by the City, or which the City by duty or custom is obliged, directly or indirectly, in any way or to any degree, to construct, repair or maintain;

(c) damage to, or trespass or encroachment upon, property owned by persons other than the City;

(d) any claim for lien or trust claim served upon the City pursuant to The Builders' Liens Act;

(e) failure to pay a Workers Compensation assessment, or Federal or Provincial taxes;

(f) unauthorized use of any design, device, material or process covered by letters patent, copyright, trademark or trade name in connection with the Work;

(g) inaccuracies in any information provided to the City by the Contractor.

D41.3 Further to C17, The City shall save harmless and indemnify the Contractor in the amount of twice the Contract Price or five million dollars ($5,000,000), whichever is greater, against all costs, damages or expenses arising from actions, claims, demands and proceedings, by whomsoever brought, made or taken as a result of negligent acts or negligent omissions of the City, their employees or agents in the performance of its obligation under the Contract.

THIRD PARTY AGREEMENTS

D42. FUNDING AND/OR CONTRIBUTION AGREEMENT OBLIGATIONS

D42.1 Funding for the Work of the Contract is being provided to the City of Winnipeg by the Government of Manitoba and/or the Government of Canada and accordingly, as required by the applicable funding agreements, the following terms and conditions shall apply.

D42.2 For the purposes of D42:

(a) **"Government of Canada"** includes the authorized officials, auditors, and representatives of the Government of Canada; and

(b) **"Government of Manitoba"** includes the authorized officials, auditors, and representatives of the Government of Manitoba.

D42.3 Indemnification By Contractor

D42.3.1 In addition to the indemnity obligations outlined in C17 of the General Conditions for Construction, the Contractor agrees to indemnify and save harmless the Government of Canada and the Government of Manitoba and each of their respective Ministers, officers, servants, employees, and agents from and against all claims and demands, losses, costs,

damages, actions, suit or other proceedings brought or pursued in any manner in respect of any matter caused by the Contractor or arising from this Contract or the Work, or from the goods or services provided or required to be provided by the Contractor, except those resulting from the negligence of any of the Government of Canada's or the Government of Manitoba's Ministers, officers, servants, employees, or agents, as the case may be.

D42.3.2 The Contractor agrees that in no event will Canada or Manitoba, their respective officers, servants, employees or agents be held liable for any damages in contract, tort (including negligence) or otherwise, for:

(a) any injury to any person, including, but not limited to, death, economic loss or infringement of rights;

(b) any damage to or loss or destruction of property of any person; or

(c) any obligation of any person, including, but not limited to, any obligation arising from a loan, capital lease or other long term obligation;

in relation to this Contract or the Work.

D42.4 Records Retention and Audits

D42.4.1 The Contractor shall maintain and preserve accurate and complete records in respect of this Contract and the Work, including all accounting records, financial documents, copies of contracts with other parties and other records relating to this Contract and the Work during the term of the Contract and for at least six (6) years after Total Performance. Those records bearing original signatures or professional seals or stamps must be preserved in paper form; other records may be retained in electronic form.

D42.4.2 In addition to the record keeping and inspection obligations outlined in C6 of the General Conditions for Construction, the Contractor shall keep available for inspection and audit at all reasonable times while this Contract is in effect and until at least six (6) years after Total Performance, all records, documents, and contracts referred to in D42.4.1 for inspection, copying and audit by the City of Winnipeg, the Government of Manitoba and/or the Government of Canada and their respective representatives and auditors, and to produce them on demand; to provide reasonable facilities for such inspections, copying and audits, to provide copies of and extracts from such records, documents, or contracts upon request by the City of Winnipeg, the Government of Manitoba, and/or the Government of Canada and their respective representatives and auditors, and to promptly provide such other information and explanations as may be reasonably requested by the City of Winnipeg, the Government of Manitoba, and/or the Government of Canada from time-to-time.

D42.5 Other Obligations

D42.5.1 The Contractor consents to the City providing a copy of the Contract Documents to the Government of Manitoba and/or the Government of Canada upon request from either entity.

D42.5.2 If the Lobbyists Registration Act (Manitoba) applies to the Contractor, the Contractor represents and warrants that it has filed a return and is registered and in full compliance with the obligations of that Act, and covenants that it will continue to comply for the duration of this Contract.

D42.5.3 The Contractor shall comply with all applicable legislation and standards, whether federal, provincial, or municipal, including (without limitation) labour, environmental, and human rights laws, in the course of providing the Work.

D42.5.4 The Contractor shall properly account for the Work provided under this Contract and payment received in this respect, prepared in accordance with generally accepted accounting principles in effect in Canada, including those principles and standards approved or recommended from time-to-time by the Chartered Professional Accountants of Canada or the Public Sector Accounting Board, as applicable, applied on a consistent basis.

D42.5.5 The Contractor represents and warrants that no current or former public servant or public office holder, to whom the Value and Ethics Code for the Public Sector, the Policy on Conflict of Interest and Post Employment, or the Conflict of Interest Act applies, shall derive direct benefit from this Contract, including any employment, payments, or gifts, unless the provision or receipt of such benefits is in compliance with such codes and the legislation.

D42.5.6 The Contractor represents and warrants that no member of the House of Commons or of the Senate of Canada or of the Legislative Assembly of Manitoba is a shareholder, director or officer of the Contractor or of a Subcontractor, and that no such member is entitled to any benefits arising from this Contract or from a contract with the Contractor or a Subcontractor concerning the Work.

ADJUSTMENTS FOR CHANGES IN LAWS, TAXES, OR TARIFFS

D43. ADJUSTMENTS FOR CHANGES IN LAWS, TAXES, OR TARIFFS

D43.1 Further to C12.4 and subject to C6.13, the Contract Price shall be adjusted if any change in a law or tax imposed under the Excise Act, the Excise Tax Act, the Customs Act, the Customs Tariff, The Mining Tax Act (Manitoba), or The Retail Sales Tax Act (Manitoba), by an act of the Congress of the United States of America, or by Executive Order by the President of the United States under the International Emergency Economic Powers Act of the United States of America or similar legislation:

(a) occurs after the Submission Deadline;

(b) applies to Material; and

(c) affects the cost of that Material to the Contractor.

D43.2 Further to C12.5, if a change referred to in C12.4 occurs, the Contract Price shall be increased or decreased by an amount equal to the amount that is established, by an examination of the relevant records of the Contractor, to be the increase or decrease in the cost incurred that is directly attributable to that change, and which the Contractor has proven to the Contract Administrator represents the minimum amount of increase necessary in order to obtain necessary Material or Plant. For the avoidance of doubt, the Contractor shall be required to provide satisfactory proof that it has investigated alternative options for obtaining equivalent Material or Plant and reducing or eliminating the increase in Contract Price, up to and including entering into purchase agreements with vendors located in other jurisdictions, in order for Contractor to be able to avail itself of the increase in Contract Price permitted.

FORM J: SUBCONTRACTOR LIST

(See D17)

CONSTRUCTION OF THE REPLACEMENT FORT GARRY-ST. VITAL SIPHONS

Name	Address

FORM K: EQUIPMENT
(See D18)

CONSTRUCTION OF THE REPLACEMENT FORT GARRY-ST. VITAL SIPHONS

1. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

2. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

3. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

FORM K: EQUIPMENT
(See D18)

CONSTRUCTION OF THE REPLACEMENT FORT GARRY-ST. VITAL SIPHONS

4. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

5. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

6. Category/type:

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

Make/Model/Year: _____ Serial No.: _____

Registered owner: _____

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS AND DRAWINGS

E1.1 These Specifications shall apply to the Work.

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

E1.2.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Purchasing Division website at http://www.winnipeg.ca/matmgt/Spec/Default.stm

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

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

E1.3 Bidders are reminded that requests for approval of substitutes as an approved equal or an approved alternative shall be made in accordance with B7. In every instance where a brand name or design specification is used, the City will also consider approved equals and/or approved alternatives in accordance with B7.

E1.4 The following are applicable to the Work:

Drawing No.	Drawing Name/Title
G-1000	Cover Sheet
G-1001	Drawing Index, Design Notes, Legend & Abbreviations
C-1000	General Plan - Construction & Staging – West Bank
C-1001	General Plan - Construction & Staging – East Bank
C-1002	Site Plan - West Bank
C-1003	Site Plan - East Bank
C-1004	Plan / Profile - D'Arcy Pumping Station to Matchline 1 + 250
C-1005	Plan / Profile - Matchline 1 + 250 to 1350 Interceptor
C-1006	Plan / Profile - Existing Discharge Manhole to Proposed Upstream Siphon Chamber
C-1007	Plan / Profile - Proposed Downstream Siphon Chamber to 1350 Interceptor
C-1008	Plan / Profile - Existing Discharge Manhole to Siphon Inlet and Overflow Chambers
C-1009	Plan / Profile – Proposed LDS
C-4001	Details 1
C-4002	Details 2
C-5001	Standard Details – Monitoring and Instrumentation
L-1001	Site Grading Plan – West Bank and East Bank
L-1002	Plan / Profile – East Side Laydown Area – Temporary Multi-Use Pathway
L-4001	Site Grading Details
S-1001	Discharge Manhole Sections & Details
S-1002	Existing Siphon Chamber Modifications – Section and Details
S-1003	Proposed Upstream Siphon Chamber - Plans & Details
S-1004	Proposed Upstream Siphon Chamber - Sections & Details
S-1005	Proposed Downstream Siphon Chamber - Plans & Details
S-1006	Proposed Downstream Siphon Chamber - Sections & Details
S-1007	West & South Gate Chamber – Roof Slab Replacement – Sections & Details
S-4001	Structural Reinforcing & Miscellaneous Details
S-2001	Discharge Manhole – Structural General Notes
S-2002	Discharge Manhole – Structural Plans and Sections
S-2003	Upstream Siphon Chamber – Structural Plans
S-2004	Upstream Siphon Chamber – Structural Sections and Details
S-2005	Downstream Siphon Chamber – Structural Plans

S-2006 Downstream Siphon Chamber – Structural Sections and Details

Appendix No.	Appendix Title
A	Geotechnical Data Report
B	Geotechnical Baseline Report
C	Design and Construction Team Experience Form
D	Record Drawings

E2. GEOTECHNICAL INVESTIGATION REPORT

E2.1 Geotechnical Data Report (GDR)

(a) The GDR summarizes the testing and geotechnical conditions observed at the project site and provides technical support for the GBR. This report includes geotechnical data collected at the project site and summary of anticipated subsurface conditions along the alignment. A copy of the GDR is included in Appendix A.

E2.2 Geotechnical Baseline Report (GBR)

(a) The GBR summarizes the geotechnical condition observed at the project site and provides construction considerations for use by Bidders for Bid preparation and administration of the Contract. Further information is provided in clause D37 and a copy of the GBR is included in Appendix B.

(b) The GBR provided in Appendix B is to be used for the Microtunneling portion of the Work, inclusive of shaft construction and tunnelling of the 2100 mm reinforced concrete pipe (RCP) crossing the Red River as shown in Drawings C-1004, C-1005, S-1003 and S-1004.

GENERAL REQUIREMENTS

E3. OFFICE FACILITIES

E3.1 The Contractor shall supply office facilities meeting the following requirements:

(a) the field office shall be for the exclusive use of the Contract Administrator;

(b) the building shall be conveniently located near the Site of the Work at a location approved by the Contract Administrator;

(c) the building shall have a minimum floor area of 25 m2, a height of 2.4 m with two (2) windows for cross ventilation and a door entrance with a suitable lock;

(d) the building shall be suitable for all weather use. It shall be equipped with an electric heater and air conditioner so that the room temperature can be maintained between either 16 and 25 degrees Celsius;

(e) the building shall be adequately lighted with fluorescent fixtures and have a minimum of three (3) wall outlets with 120 volt power supply;

(f) the building shall be furnished with one (1) desk, one drafting table, table 3 m X 1.2 m, one (1) stool, one (1) four-drawer legal size filing cabinet, and a minimum of 12 chairs;

(g) the building shall be equipped with one (1) microwave, one (1) fridge, and one (1) water cooler with pick up and deposit of water jugs on a weekly basis;

(h) a portable toilet shall be located near the field office building. The toilet shall have a locking door and be for the exclusive use of the Contract Administrator and other personnel from the City; and

(i) the field office building and the portable toilet shall be cleaned on a weekly basis immediately prior to each Site meeting. The Contract Administrator may request additional cleaning when he/she deems it necessary.

E3.2 The office facilities will be provided from the date of the commencement of the Work to the date of Substantial Performance.

E3.3 Parking for a minimum of three (3) vehicles shall be provided for the Contract Administrator in close proximity to the office trailer.

E3.4 Measurement and Payment

E3.4.1 Procurement, installation and removal costs, all operating costs, and the general maintenance of the office facilities will be considered incidental to “Mobilization and Demobilization” and will not be measured for payment. No additional payment will be made.

E4. SHOP DRAWINGS

E4.1 Description

(a) This Specification shall revise, amend, and supplement the requirements of CW 1110 of the City of Winnipeg’s Standard Construction Specifications.

(b) 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.

E4.2 Submit all Shop Drawings in accordance with CW 1110 except as modified herein.

E4.3 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 shown on all submissions.

E4.4 Shop Drawings

(a) Original drawings are to be prepared by Contractor, Subcontractor, Supplier, Distributor, or Manufacturer, which illustrate appropriate portion of Work; showing fabrication, layout, setting or erection details as specified in appropriate sections.

(b) Shop drawings for the following structural components shall bear the seal of a Registered Professional Engineer in the Province of Manitoba.

(i) Shoring

(ii) Steel Reinforcement

(iii) Metal Fabrications

(iv) Pre-cast concrete structures

(v) Reinforced Concrete Jacking Pipe

- The Contractor must provide pipes that can be installed with their intended means and methods. The Contractor must provide a submission that demonstrates that the proposed pipe can support the anticipated loading applied to the pipe.

(vi) Thrust/Jacking Wall

- A thrust wall shop drawing is required for any trenchless technology that requires applying thrust as part of its process. The interaction of the thrust with respect to shoring, existing soil conditions, existing utilities or other site-specific issues must be addressed by the thrust wall design.

(c) Additional submittal requirements for each component of Work may be listed within the relevant specification section.

(d) Construction of any Work item requiring a shop drawing may not commence until the specific shop drawing submittal has been accepted.

(i) No shaft construction may proceed without accepted shop drawings that include engineered stamped drawings demonstrating that the shoring design(s):

- Meet all provincial regulations.
- Is able to support soil and active loading.
- Permits the effective installation of the planned works.

- Demonstrates that the shoring also supports the planned tunnelling works as well as interaction with the thrust block design (where shafts are used to facilitate tunnelling).

E4.5 Contractors Responsibility

E4.5.1 Review shop drawings, product data and samples prior to submission and stamp and sign drawings indicating conformance to the Contract requirements.

E4.5.2 Verify:

(a) Field Measurements

(b) Field Construction Criteria

(c) Catalogue numbers and similar data

E4.5.3 Coordinate each submission with requirements of Work and Contract Documents. Individual shop drawings will not be reviewed until all related drawings are available.

E4.5.4 Notify Contract Administrator, in writing at time of submission, of deviations from requirements of Contract Documents.

E4.5.5 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.

E4.5.6 Responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.

E4.5.7 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.

E4.5.8 After Contract Administrator's review and return of copies, distribute copies to Subcontractors s as appropriate.

E4.5.9 Maintain one (1) complete set of reviewed shop drawings, filed by Specification Section Number, at the Site of the Work for use and reference of the Contract Administrator and Subcontractors.

E4.6 Submission Schedule:

(a) Schedule submissions at least fourteen (14) Calendar Days before dates reviewed submissions will be needed and allow for a seven (7) Calendar Day period for review by the Contract Administrator of each individual submission and re-submission, unless noted otherwise in the Contract Documents. Submit shop drawings within the timeframe specified herein.

E4.7 Shop Drawings not meeting the requirements of CW 1110 or the requirements specified herein will be returned to the Contractor without review for resubmission.

E4.8 Shop drawing submissions will be limited to two (2) reviews per shop drawing. This shall include a review of the initial submission and a review of the revised submission. Costs associated with subsequent reviews will be charged to the Contractor.

E5. HERITAGE RESOURCE PROTECTION

E5.1 The Project Site has been identified as having the potential to impact heritage resources. Monitoring of the excavations will be required, and access shall be made available to the Contract Administrator during the course of excavation.

E5.2 In the event that a heritage resource is discovered resulting in a stop work order, compensation for delays shall be as per C7. The Contractor shall reasonably re-deploy resources to limit cost and schedule impacts until the stop work order is resolved.

E6. ENVIRONMENTAL PROTECTION

E6.1 The Contractor shall plan and implement the Work of this Contract strictly in accordance with the requirements of the environmental protection measures as herein specified.

E6.2 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:

E6.2.1 Federal

(a) Canadian Environmental Protection Act (CEPA) c.16;

(b) Canadian Environmental Assessment Act (CEAA) c.37;

(c) Transportation of Dangerous Goods Act and Regulations c.34; and

(d) Migratory Birds Convention Act, 1994

(e) Fisheries Act, 1985

(f) Department of Fisheries and Oceans Act, 1985

(g) Migratory Birds Convection Act, 1994

(h) Canadian Navigable Waters Act, 1985

E6.2.2 Provincial

(a) The Dangerous Goods Handling and Transportation Act D12;

(b) The Endangered Species Act E111;

(c) The Environment Act c.E125;

(d) The Fire Prevention Act F80;

(e) The Manitoba Heritage Resources Act H39.1;

(f) The Manitoba Noxious Weeds Act N110;

(g) The Manitoba Nuisance Act N120;

(h) The Public Health Act c.P210;

(i) The Workplace Safety and Health Act W120; and

(j) And current applicable associated regulations.

E6.2.3 Municipal

(a) The City of Winnipeg By-law no. 1/2008;

(b) The City of Winnipeg Waterway By-Law no. 5888/92; and

(c) Other applicable Acts, Regulations and By-laws.

E6.3 The Contractor is advised that the following environmental protection measures apply to the Work.

E6.3.1 Materials Handling and Storage

(a) Construction materials and debris shall be prevented from entering drainage pipes or channels.

(b) Construction materials and debris shall also be prevented from accumulating on local roadways and sidewalks when tracked out of the Site by trucks hauling excavated materials.

(c) The Contractor shall provide on-Site measures to mitigate the tracking of sediment off-Site and therefore reduce the amount of street cleaning required. These measures

may take the form of a truck wheel wash (automated or manually operated) or other measures as approved by the Contract Administrator.

E6.3.2 Fuel Handling and Storage

(a) The Contractor shall obtain all necessary permits from Manitoba Conservation for the handling and storage of fuel products and shall provide copies to the Contract Administrator.

(b) All fuel handling and storage facilities shall comply with The Dangerous Goods and Transportation Act Storage and Handling of Petroleum Products Regulation and any local land use permits.

(c) Fuels, lubricants, and other potentially hazardous materials as defined in The Dangerous Goods and Transportation Act shall be stored and handled within the approved storage areas.

(d) The Contractor shall ensure that all fuel storage containers are inspected daily for leaks and spillage.

(e) Products transferred from the fuel storage area(s) to specific Work Sites shall not exceed the daily usage requirement.

(f) When servicing requires the drainage or pumping of fuels, lubricating oils or other fluids from equipment, a groundsheet of suitable material (such as HDPE) and size shall be spread on the ground to catch the fluid in the event of a leak or spill.

(g) Refuelling of mobile equipment and vehicles shall take place at least 100 metres from a watercourse.

(h) The area around storage Sites and fuel lines shall be distinctly marked and kept clear of snow and debris to allow for routine inspection and leak detection.

(i) A sufficient supply of materials, such as absorbent material and plastic oil booms to clean up minor spills shall be stores nearby on-site. The Contractor shall ensure that additional material can be made available on short notice.

E6.3.3 Waste Handling and Disposal

(a) The construction area shall be kept clean and orderly at all times during and at completion of construction.

(b) At no time during construction shall personal or construction waste be permitted to accumulate for more than one day at any location on the construction site, other than at a dedicated storage area as may be approved by the Contract Administrator.

(c) All resulting debris shall be deposited at a Waste Disposal Ground operating under the authority of Manitoba Regulation #150/91. Exceptions are liquid industrial and hazardous wastes which may require special disposal methods (see SC:21.4 D).

(d) Indiscriminate dumping, littering, or abandonment shall not take place.

(e) No on-site burning of waste is permitted.

(f) Waste storage areas shall not be located so as to block natural drainage.

(g) Run-off from a waste storage area shall not be allowed to cause siltation of a watercourse.

(h) Waste storage areas shall be left in a neat and finished appearance and/or restored to their original condition to the satisfaction of the Contract Administrator.

(i) Equipment shall not be cleaned near watercourses; contaminated water from onshore cleaning operations shall not be permitted to enter watercourses.

E6.3.4 Dangerous Goods/Hazardous Waste Handling and Disposal

(a) Dangerous goods/hazardous waste are identified by, and shall be handled according to, The Dangerous Goods Handling and Transportation Act and Regulations.

(b) The Contractor shall be familiar with The Dangerous Goods Handling and Transportation Act and Regulations.

(c) The Contractor shall have on-site staff that is trained and certified in the handling of the dangerous/hazardous goods, when said dangerous/hazardous goods are being utilized on-site for the performance of the Work.

(d) Different waste streams shall not be mixed.

(e) Disposal of dangerous goods/hazardous wastes shall be at approved hazardous waste facilities.

(f) Liquid hydrocarbons shall not be stored or disposed of in earthen pits on-site.

(g) Used oils shall be stored in appropriate drums, or tankage, until shipment to waste oil recycling centres, incinerators, or secure disposal facilities approved for such wastes.

(h) Used oil filters shall be drained, placed in suitable storage containers, and buried or incinerated at approved hazardous waste treatment and disposal facilities.

(i) Dangerous goods/hazardous waste storage areas shall be located at least 100 metres away from the high water line and be diked.

(j) Dangerous goods/hazardous waste storage areas shall not be located so as to block natural drainage.

(k) Run-off from a dangerous goods/hazardous waste storage area shall not be allowed to cause siltation of a watercourse.

(l) Dangerous goods/hazardous waste storage areas shall be left in a neat and finished appearance and/or restored to their original condition to the satisfaction of the Contract Administrator.

E6.3.5 Emergency Response

(a) The Contractor shall ensure that due care and caution is taken to prevent spills.

(b) The Contractor shall report all major spills of petroleum products or other hazardous substances with the potential for impacting the environment and threat to human health and safety to the Contract Administrator and Manitoba Environment, immediately after occurrence of the environmental accident, by calling the 24-hour emergency telephone phone number (204) 945-4888. The Contract Administrator shall also be notified.

(c) The Contractor shall designate a qualified supervisor as the on-site emergency response coordinator for the project. The emergency response coordinator shall have the authority to redirect manpower in order to respond in the event of a spill.

(d) The following actions shall be taken by the person in charge of the spilled material or the first person(s) arriving at the scene of a hazardous material accident or the on-site emergency response coordinator:

(i) Notify emergency-response coordinator of the accident:

- identify exact location and time of accident
- indicate injuries, if any
- request assistance as required by magnitude of accident (Manitoba Environment 24-hour Spill Response Line (204) 945-4888, Police, Fire Department, Ambulance, company backup)

(ii) Attend to public safety:

- stop traffic, roadblock/cordon off the immediate danger area
- eliminate ignition sources
- initiate evacuation procedures if necessary

(iii) Assess situation and gather information on the status of the situation, noting:

- personnel on site
- cause and effect of spill
- estimated extent of damage
- amount and type of material involved

- proximity to waterways and the Aqueduct

(iv) If safe to do so, try to stop the dispersion or flow of spill material:

- approach from upwind
- stop or reduce leak if safe to do so
- dike spill material with dry, inert sorbent material or dry clay soil or sand
- prevent spill material from entering waterways and utilities by diking
- prevent spill material from entering Aqueduct manholes and other openings by covering with rubber spill mats or diking

(v) Resume any effective action to contain, clean up, or stop the flow of the spilled product.

(e) The emergency response coordinator shall ensure that all environmental accidents involving contaminants shall be documented and reported to the Manitoba Environment according to The Dangerous Goods Handling and Transportation Act Environmental Accident Report Regulation 439/87.

(f) When dangerous goods are used on-site, materials for containment and cleanup of spill material (e.g. absorbent materials, plastic oil booms, and oversized recovery drums) shall be available on-site.

(g) Minor spills of such substances that may be contained on land with no significant impact on the environment may be responded to with in-house resources without formal notification to Manitoba Environment.

(h) City emergency response, 9-1-1, shall be used if other means are not available.

E6.4 Vegetation

(a) Vegetation shall not be disturbed without written permission of the Contract Administrator. The Contractor shall protect plants which may be at risk of accidental damage. Such measures may include protective fencing or signage and shall be approved in advance by the Contractor Administrator.

(b) Herbicides and pesticides shall not be used adjacent to any surface watercourses.

(c) All landowners adjacent to the area of application of herbicides or pesticides shall be notified prior to the Work.

(d) Trees and shrubs shall not be felled into watercourses.

(e) Areas where vegetation is removed during clearing, construction, and decommissioning activities, shall be revegetated as soon as possible in accordance the requirements outlined herein, or as directed by the Contract Administrator.

E6.5 Measurement and Payment

(a) Adherence to the laws that govern the requirements for Environmental Protection are incidental to the Contract.

E7. SITE DEVELOPMENT, MOBILIZATION AND DEMOBILIZATION

E7.1 Description

(a) This Specification shall govern Mobilization and Demobilization from site, including temporary works necessary to access the site and complete the Work.

E7.2 Site Development Plan

E7.2.1 The Contractor shall provide the Contract Administrator with a Site Development Plan at least ten (10) Business Days prior to the commencement of any Work on the Site.

E7.2.2 The Site Development Plan shall at a minimum include:

(a) Work areas on both sides of the river showing location of all required elements to complete the Work including fencing, gates, drainage and tree protection;

(b) Material staging and laydown areas, including fencing and gates;

(c) Staging areas for other Work elements, including:

(i) Slurry separation plant;

(ii) Crane Pads; and

(iii) 914 mm DR 11 HDPE fusing.

(d) Site access roads;

(e) Multiuse path relocation and/or closure;

(f) Office facility locations for Contract Administrator and Contractor;

(g) Temporary vehicle access/egress locations; and

(h) Staging of Work around and protection of the Branch II Aqueduct and Fort Garry-St. Vital Feeder Main.

E7.3 Temporary Access Roads

(a) The contractor shall design and construct site access roads as shown on the Drawings.

(b) Access road shall be constructed to permit access to the site by all equipment and materials required to undertake the works.

(c) Access roads shall kept in a rut free and well maintained condition.

E7.4 Security Fence

E7.4.1 The temporary security fencing shall meet the following requirements:

(a) Constructed of premanufactured steel panel sections;

(b) Minimum height of 1.8 m in height;

(c) Steel rails, posts, and fencing;

(d) Non-Climbing fence ;

(e) Fence sections shall be clamped or bolted together to eliminate easy disassembly; and

(f) Fence sections shall be anchored to the ground and securely fastened to the existing fence at the termination points.

E7.5 Site Office

(a) See E3.

E7.6 Measurement and Payment

E7.6.1 Mobilization and Demobilization

(a) Mobilization and demobilization will be measured on a lump sum basis and paid for at the Contract Lump Sum Price for “Mobilization and Demobilization” as listed in Form B: Prices. Payment for Mobilization and demobilization shall include but is not limited to the following:

(i) all costs associated with mobilization and demobilization;

(ii) development of site access roads;

(iii) development lay down areas;

(iv) removal of trees;

(v) erection, maintenance, and removal of security fencing and gates;

(vi) installation, maintenance, and removal of silt fencing;

(vii) supply and maintenance of site office facilities;

(viii) site cleanup;

(ix) restoration of fences;

(x) any other material and labour specified herein and required to complete the work; and

(xi) Trees requiring replacement due to construction activities shall be installed in accordance with CW 3510, as directed by the Contract Administrator. The Contractor will not be reimbursed under a separate pay item for replacing trees damaged by construction activities. The work will be considered incidental to the Work.

(b) Payment for Mobilization and Demobilization will be made on the following schedule:

(i) Sixty percent (60%) payment of the Mobilization and Demobilization lump sum price will be paid once the Contractor has completed the necessary site access modifications, site setup, and commenced with work on site.

(ii) The remaining forty percent (40%) of the Mobilization and Demobilization lump sum price will be paid subsequent to the completion of the works, site cleanup, restoration of existing fencing, and removal of temporary access roads.

(iii) Notwithstanding E7.6.1(b)(i) the initial payment for Mobilization and Demobilization will be limited to five percent (5%) of the total Contract value.

E8. TREE PROTECTION, PRUNING AND REMOVAL

E8.1 Description

E8.1.1 This specification covers the pruning and removal of existing trees as required to facilitate construction.

E8.1.2 This specification amends CW 3010 Clearing and Grubbing.

E8.2 Quality Control

E8.2.1 Person performing work shall possess a valid Manitoba Arborists License.

E8.3 Materials

E8.3.1 Wound Dressing

(a) Wound dressing shall be horticultural accepted non-hardening bituminous emulsion, free of materials toxic to callus formation, containing disinfectant for fungal and other diseases.

E8.4 Construction Methods

E8.4.1 The Contractor shall take the following precautionary steps to prevent damage from construction activities to existing boulevard trees within the limits of the construction area:

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

(b) Trees identified to be at risk by the Contract Administrator are to be strapped with 25 x 100 x 2400 mm wood planks, or suitably protected as approved by the Contract Administrator.

(c) Excavation shall be performed in a manner that minimizes damage to the existing root systems. Where possible, excavation shall be carried out such that the edge of the excavation shall be a minimum of 1.5 times the diameter (measured in inches), with the outcome read in feet, from the closest edge of the trunk. Where roots must be cut to facilitate excavation, they shall be pruned neatly at the face of excavation.

(d) Operation of equipment within the dripline of the trees shall be kept to the minimum required to perform the work required. Equipment shall not be parked, repaired, refuelled; construction materials shall not be stored, and earth materials shall not be stockpiled within the driplines of trees. The dripline of a tree shall be considered to be the ground surface directly beneath the tips of its outermost branches. The Contractor shall ensure that the operations do not cause flooding or sediment deposition on areas where trees are located.

(e) Work on-site shall be carried out in such a manner so as to minimize damage to existing tree branches. Where damage to branches does occur, they shall be neatly pruned.

E8.4.2 All damage to existing trees caused by the Contractor's activities shall be repaired to the requirements and satisfaction of the Contract Administrator and the City Forester or his/her designate.

E8.4.3 Scheduling of Work

(a) The Contractor shall review work with Contract Administrator prior to starting work.

(b) The Contractor shall schedule the work in accordance with the restrictions set out in the federal Migratory Birds Convention Act, 1994.

(i) The Project Site is considered Zone B4 and spans dates of April 30 to August 18.

E8.4.4 Removal

(a) If the Contractor requires removing trees to access the Site or facilitate construction, the Contractor shall submit a plan to the Contract Administrator for review, a minimum of ten (10) Business Days prior to removal. No removals of trees shall be made without written acceptance by the Contract Administrator and the City of Winnipeg's Forestry Department. The plan shall at a minimum indicate:

(i) Trees requiring removal complete with size and species, and description of requirement for removal.

(b) Replanting requirements will be determined by the level of tree removals proposed and accepted by the Contract Administrator and City of Winnipeg's Forestry Department.

E8.4.5 Pruning

(a) Prune individual trees as indicated by the Contract Administrator. Remove dead, dying, diseased, interfering, objectionable and weak growth in order to promote healthy development suitable to the purpose for which plant material is grown.

(b) Prune in accordance with Agriculture Canada Publication 1505-1977, The Pruning Manual.

(c) Employ clean sharp tools and make cuts flush with main branch, smooth and sloping as to prevent accumulation of water. Remove projecting stumps on trunks or main branches. Remove dead and injured branches and branches that rub causing damage to bark. Trim trees without changing their natural shape. Do not damage lead branches or remove smaller twigs along main branches.

E8.4.6 Cut Back

(a) Eliminate narrow crotches as much as possible; avoid cutting back to small suckers. Remove smaller limbs and twigs to leave foliage evenly distributed.

(b) When reducing overall size, make symmetrical in appearance to maintain tree-like form typical of species.

(c) Do not remove more than one-third of total branching at single operation.

E8.4.7 Repair and Protection

(a) Repair cuts and old scars in accordance with Agriculture Canada Publication 1505-1977, The Pruning Manual.

(b) Paint new cuts 100mm in diameter and over with wound dressing.

E8.5 Method of Measurement and Basis of Payment

E8.5.1 Pruning and removal of trees will be considered incidental to “Mobilization and Demobilization” and will not be measured for payment. No additional payment will be made.

E9. CONFINED SPACE ENTRY

E9.1 Description

(a) This Specification shall outline minimum requirements for confined space operations and provision of support for third party inspections through the course of the work.

E9.2 General

E9.2.1 The Contractor shall be aware that Hydrogen Sulphide Gas is present in all underground structures connected to the City’s sewer systems and has been known to accumulate in concentrations sufficient to cause serious harm or death to personnel who are not using adequate Personal Protective Equipment.

E9.2.2 The Contractor’s attention is drawn to the Province of Manitoba Workplace Safety and Health Act (‘the Act”), and the Regulations and Guidelines there-under pertaining to Confined Space Entry Work and in particular the requirements for conducting hazard/risk assessments and providing personal protective equipment (PPE).

E9.2.3 The Contractor is responsible for all safety and confined space support the Work.

E9.3 Methods

E9.3.1 Hazard Assessment

(a) In conjunction with securing the site and obtaining underground clearances, the Contractor shall conduct a hazard assessment for each site requiring work within a sewer or manhole. The assessment shall identify and evaluate the hazards, including but not be limited to review of the following as it pertains to the work to be performed:
   (i) nature of the defect;
   (ii) location of the defect in the sewer/manhole;
   (iii) structural condition and amount of debris in the remaining sewer/manhole;
   (iv) condition of the manholes up and downstream of the required repair;
   (v) atmospheric conditions in the manholes up and downstream of the required repair;
   (vi) condition of adjacent downstream sewers; and
   (vii) flow in the sewer.

(b) The hazard assessment shall be based on the Contractors review of the sewer(s) and site inspection of the manholes, sewers and external conditions. Prior to the inspection, the Contractor shall conduct the necessary atmospheric monitoring of the affected manholes and sewers to establish acceptable entry conditions.

E9.3.2 Safe Work Plan

(a) Subsequent to performing a hazard assessment the Contractor shall develop a safe work plan to address the potential hazards associated with each site. In addition to addressing the potential hazards the safe work plan shall address but not be limited to the following:
   (i) guidelines for confined space entry work established by The Manitoba Workplace Safety and Health Act;
   (ii) provision for emergency response;
   (iii) training and duties for entry personnel;
   (iv) rescue and emergency services;

(v) requirement for purging, ingesting, flushing and/or continuous ventilation to eliminate or control atmospheric hazards;

(vi) requirement for and provision of supplied air;

(vii) communication between members of the repair crew in the pipe and on the ground's surface;

(viii) current and forecasted weather conditions;

(ix) isolating the workspace by plugging of upstream sewers and monitoring of upstream flow levels;

(x) provision of back-up equipment;

(xi) method of ingress into the sewer; and

(xii) method of egress out of the sewer – forward and backwards.

(b) The Contactor shall not enter the sewer or manholes to begin the work until they have completed a hazard assessment and safe work plan for the specific work and reviewed the plans with their designated safety officer for acceptance. The safe work plan procedures and practices shall conform to all federal, provincial and municipal codes, regulations and guidelines including Manitoba Workplace Safety and Health Regulations.

E9.3.3 Enter the Manhole and Sewer

(a) The Contractor shall enter the manhole/sewer and complete the work in accordance with their safe work plan and requirements for the repair contained herein.

(b) If at any time during the repair the attendant and/or Contractor believes he cannot safely perform the work they shall immediately stop the work and evacuate the sewer and manholes. The Contractor shall re-assess their safe work plan considering the reason for the work stoppage. The work shall only be resumed when the Contractor has deemed it safe to return by completing a re-assessment and safe work plan revision, where necessary.

E9.4 Measurement and Payment

E9.4.1 Confined Space Entry

(a) Confined space entry support as outlined herein will be considered incidental to the Work and will not be measured for payment. No separate payment will be made.

E10. WATER SUPPLY

E10.1 Further to Section 3.14 of CW 2140 and Section 3.7 of CW 1120 of the General Requirements water supply for the Work may be taken from City of Winnipeg hydrants.

E10.2 The Contractor shall make the following arrangements for hydrant turn on and turn off.

(a) Contact City of Winnipeg Water Services Division (WSD) for hydrant turn on and turn off required between 0800 hours and 1500 hours Monday to Friday. Notice for turn on and turn off shall be provided a minimum of 24 hours in advance.

(b) Contact Emergency Services Branch (204-986-2626) with a minimum of 2 hours notice for hydrant turn on and turn off required outside of the above hours.

(c) The Contractor shall wait at the hydrant from the requested turn on or turn off time until City staff arrives to turn on or turn off the hydrant.

E10.3 Hydrants shall be considered to be "in the Contractor's control" from the time the City has turned the hydrant on until the City has turned the hydrant off.

E10.4 Between November 1 and April 30 of any year, or whenever freezing temperatures are occurring or anticipated the Contractor shall take all necessary precautions to prevent freezing of hydrants and related appurtenances for hydrants in their control and shall be responsible to pump out hydrants turned off by Emergency Services.

E10.5 If a hydrant or appurtenance is damaged due to freezing or improper turn on or turn off procedures while in the Contractor's control, WSD will assess the damage and determine if WSD will repair the damage or if the Contractor will be responsible to repair the damage. Costs for repairs completed by WSD will be deducted from payments owing the Contractor. Repairs completed by the Contractor will be at the Contractor's expense.

E10.6 The Contractor shall provide a traffic ramp for hydrant connection hoses that cross roadways. The ramp shall be designed and constructed to not present a hazard to vehicles travelling over it and to ensure that no part of the hose is run over by a motor vehicle.

E10.7 Measurement and Payment

(a) Charges incurred for the permits and water meters shall be paid for by the Contractor when the permit is 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.

(b) All other costs associated with sourcing construction water will be considered incidental to the Work and will not be measured for payment. No additional payment will be made.

E11. WATER BY-LAW

E11.1 The Contractor shall note that all works within 106.7 m (350 ft) of the regulated summer water level of the Red River within the City of Winnipeg are within the jurisdiction of the Waterway By-Law and requires a Waterway Permit prior to commencing construction. The Contract Administrator shall arrange for the Waterway Permit, and is expected to be in place prior to construction.

E11.2 Under no circumstances will stockpiling of any material be permitted within the designated regulated area of the Red River waterway and adjacent lands.

E12. WATERWAYS PROTECTION

E12.1 All work adjacent to or crossing waterways including creeks and ditches draining into a waterway is regulated by the Federal Department of Fisheries and Oceans (DFO). The Contractor must implement the Work in accordance with DFO guidelines and regulations.

E12.2 Contractor to follow E5 Environmental Protection and the City of Winnipeg's *Best Management Practices Handbook for Activities In and Around the City's Waterways and Watercourses* (City of Winnipeg, 2005).

E12.3 No separate measurement or payment will be made for Waterways Protection and will be considered incidental to the Work.

E13. RED RIVER WATER LEVELS

E13.1 Normal Red River water levels are as follows:

(a) Average Summer River Level (ASRL) – 224.312 m (geodetic).

(b) Average Winter River Level (AWRL) – 222.165 m (geodetic).

(c) Flood Protection Water Level (FPWL) – 230.892 m (geodetic).

E13.2 The Red River in Winnipeg is regulated in the summer at the approximate ASRL listed and efforts are made to lower the river to the AWRL in the winter months. However, annual flooding occurs in the Red River Valley and water levels can fluctuate greatly from year to year and month to month and no guarantees are made that the water level will be at the levels indicated. For more information on past river levels within the City of Winnipeg, visit https://winnipeg.ca/waterandwaste/flood/riverLevels.stm

E13.3 Contractor shall schedule the work and layout of the site so that the Red River water levels will not impact the Works.

E13.4 Occurrence of high river levels during construction of the Work will not be considered a basis for claim for extra work or extra time.

E13.5 Contractor is responsible to secure the site in the event of any high river elevations that may impact the work.

E14. CASH ALLOWANCE FOR ADDITIONAL WORK

E14.1 Additional Work may be necessitated due to unforeseen circumstances that may arise during the course of the project due to:

(a) Additions to the scope of Work by the Contract Administrator, beyond that defined herein.

E14.2 A cash allowance has been included on Form B: Prices.

E14.3 The City reserves the right to delete any or all of the Cash Allowance from the Contract if the Work intended to be covered by the Cash Allowance is not required, or if the Works intended are found to be more extensive than the provisional Cash Allowance.

E14.4 Cost of additional work shall be evaluated by the methods outlined in C7.4, and a Change Order prepared by the Contract Administrator. Cost of the Change Order will be paid on the Progress Estimate and deducted from the Cash Allowance. If the valuation of the authorized work exceeds the Value of the Cash Allowance, the Contract Value will be adjusted by the shortfall.

E14.5 Additional services and/or Work will not be initiated for:

(a) Reasons of lack of performance or errors in execution.

(b) Scheduling changes initiated by the City, where at least 24 hours' notice is given prior to the Contractors schedule time to be on Site.

E14.6 Should it be determined that additional material or services are required, the Contract Administrator shall approve the Work, prior to commencement of the additional Work.

E14.7 Material Mark-Up Factors in accordance with C7:

(a) The base cost is to be the wholesale cost of the material, regardless of the Contractor or Subcontractor supplying the material.

(b) In general, the party (Contractor or Subcontractor) supplying the material is the party that purchases the material from a supplier who does not perform any work on Site, unless otherwise determined by the Contract Administrator.

(c) Where the Contractor is supplying the material, the mark-up on the material is limited to fifteen percent (15%).

(d) Where the Contractor's immediate Subcontractor is supplying the material the total mark-up on the material including all Subcontractors and the Contractor is limited to twenty-five percent (25%).

(i) The Subcontractor's mark-up on the material is limited to fifteen percent (15%).

(ii) The Contractor's mark-up on the material is limited to ten percent (10%).

(e) A Third-Level Subcontractor is a Subcontractor of a Subcontractor of the Contractor.

(i) No Third-Level Subcontractors on this project are approved for additional mark-up.

(ii) In the event that a Third-Level Subcontractor is utilized, that is not approved for additional mark-up, the Contractor is responsible for coordinating the split of the maximum approved mark-up between the Contractor and Subcontractors.

E15. CHANGE IN CONTRACT CONDITIONS

E15.1 Description

(a) This specification covers changes identified to the scope of work including changes in geotechnical and geological conditions that may impact the construction of the tunnelling shafts and tunnelling operations.

(b) The basis for the geotechnical and geologic conditions are described in the GBR and GDR as defined in D34.

(c) If during the tunnelling shaft construction operations should geotechnical conditions differing from those defined in the GBR which prevent progress of the shaft construction, the Contractor shall notify the Contract Administrator immediately. The Contractor shall correct the condition or otherwise make it possible for the shaft construction to continue through removal of the obstruction or modification of the methods employed. Upon written notification by the Contract Administrator, the Contractor shall immediately proceed with object removal, remedial works, or equipment retrofit as necessary to permit continuation of the works.

(d) If the tunnelling operations should encounter geotechnical conditions differing from those defined in the GBR that prevent the forward progress of the MTBM, the Contractor shall notify the Contract Administrator immediately. The Contractor shall correct the condition or otherwise make it possible for the TBM to advance past any obstructions or conditions that impede forward progress of the TBM. Upon written notification by the Contract Administrator, the Contractor shall immediately proceed with object removal, remedial works, or equipment retrofit as necessary to permit continuation of the tunnelling works.

(e) The method for reviewing, recording and accepting a change to geotechnical and geologic conditions or obstructions is described in section D37.

E15.2 Measurement and Payment

(a) The Contractor will receive compensation for encountered geotechnical conditions that are materially different than those identified in the Geotechnical Baseline Report and as defined in D34 and D37 during construction of tunnelling construction shafts and the tunnelling work.

(b) Compensation for delays and additional costs will be evaluated based on the type and extent of delay and the Equipment costs identified in Part H of Form B: Prices for the respective type of work being performed.

E16. WORK IN PROXIMITY TO CRITICAL WATER INFRASTRUCTURE

E16.1 Close proximity shall be deemed to be any construction activity within a 5 m offset from the centreline of the Branch II Aqueduct and other Critical Water Infrastructure. Contractors carrying out repair work or working in close proximity to Critical Water Infrastructure shall meet the following conditions and technical requirements:

E16.2 Critical Water Infrastructure on this Site includes;

(a) 1676 mm Branch II Aqueduct including West Tunnel Shaft, East Tunnel Shaft and valve chambers.

(b) 600 mm Fort Garry-St. Vital (FGSV) Feeder Main.

E16.3 General Considerations

(a) The Branch II Aqueduct and FGSV Feeder Main are a critical components of the City of Winnipeg Regional Water Supply System and work in close proximity to the pipeline shall be undertaken with an abundance of caution. The pipe cannot be taken out of service to facilitate construction and inadvertent damage caused to the pipe would likely have catastrophic consequences.

(b) Work around the Aqueduct and feeder mains shall be planned and implemented to minimize the time period that work is carried out in close proximity to the pipe and to

ensure that the pipeline is not subjected to excessive construction related loads, including excessive vibrations and/or concentrated or asymmetrical lateral loads during backfill placement.

(c) Large diameter pressure pipe generally has limited ability to withstand increased earth and live loading. Therefore, every precaution must be undertaken to ensure that applied loading during all phases of construction is within accepted loading parameters.

E16.4 Submittals

E16.4.1 The Contractor shall submit the proposed construction equipment specifications and construction method statements specific to portions of the work. The following schedule based on Work item may be used:

(a) Discharge Chamber and 1350 Gravity Sewer;

(b) St. Vital Trunk Connection Manhole and 1350 Gravity Sewer;

(c) 600 mm Overflow, 500 mm Forcemain and 1350 Gravity Overflow Rehabilitation;

(d) General Site Lay Down;

(e) Restoration; and

(f) Any other works in close proximity to Critical Water Infrastructure.

E16.4.2 Submit proposed construction equipment specifications to the Contract Administrator for review a minimum of ten (10) Business Days prior to construction. The equipment submission shall include:

(a) equipment operating and payload weights;

(b) equipment dimensions, including wheel or track base, track length or axle spacing, track widths or wheel configurations; and

(c) load distributions in the intended operating configuration.

E16.4.3 Submit a construction method statement to the Contract Administrator a minimum of ten (10) business days prior to construction. The construction method statement shall contain the following minimum information:

(a) proposed construction plan including excavation locations, haul routes, excavation equipment locations, and loading positions.

(b) excavation plans, including shoring designs, for excavations occurring in close proximity to Critical Water Infrastructure (within 5 m horizontal of the pipe's centerline) where the excavation to be extended below the top of the Critical Water Infrastructure embedment zone (150 mm above the pipe).

(c) any other pertinent information required to accurately describe the construction activities in close proximity to the Critical water Infrastructure and permit the Contract Administrator to review the proposed construction plans.

E16.5 Pre-Work, Planning and General Execution

(a) No work shall commence at the site until the equipment specifications and construction method statement have been submitted and accepted, and Critical Water Infrastructure locations have been clearly delineated in the field. Work over Critical Water Infrastructure shall only be carried out with equipment that has been reviewed and quantified in terms of its loading implications on the pipe. All proposed construction equipment must be submitted to Contract Administrator for review prior to construction.

(b) Contact the City of Winnipeg WWD Department, Construction Services Coordinator prior to construction.

(c) Locate Critical Water Infrastructure and confirm their position horizontally and vertically at the proposed locations prior to undertaking work in close proximity to the identified Critical Water Infrastructure. Note, exact locations to be identified in the field.

(d) Visually delineate all Critical Water Infrastructure identified herein on Site by use of paint, staking/flagging, construction fencing, snow fencing, or other suitable methods.

(e) Where work is in close proximity to the Branch II Aqueduct and feeder mains, utilize construction practices and procedures that do not impart excessive vibration loads on the pipeline or that would cause settlement of the subgrade below the pipeline.

(f) For construction work activities either longitudinally or transverse to the alignment of the Critical Water Infrastructure, work only with equipment and in the manner stipulated in the accepted construction method statement(s) and the requirements noted herein.

(g) Construction operations should be staged in such a manner as to limit multiple construction loads at one time (e.g. offset crossings sufficiently from each other, rollers should remain a sufficient distance behind spreaders to limit loads. A reasonable offset distance is 3m between loads).

(h) Granular material, construction material, soil, and/or other material shall not be stockpiled on or within 5 m of any Critical Water Infrastructure.

(i) Vibratory equipment shall not be utilized within 5 metres of the centreline of the Critical Water Infrastructure.

(j) Prior to commencement of on-site work, the Contractor shall jointly conduct an orientation meeting with the Contractor Administrator with all superintendents, foremen and heavy equipment operators to make all workers on site fully cognizant of the limitations of altered loading on the Aqueduct and feeder mains, the ramifications of inadvertent damage to the pipelines, the constraints associated with work in close proximity to the Aqueduct and feeder mains and the specific details of the Construction Method Statement in instances where a Construction Method Statement is in effect. New personnel introduced after commencement of the project need to be formally orientated as to the significance and constraints associated with working over the Branch II Aqueduct and feeder mains.

(k) Employees of the Contractor or any Subcontractor that fail to comply with the conditions for working in close proximity to the Aqueduct and feeder mains and shall be promptly removed from the Site.

E16.6 Demolition and Excavation

(a) Expose sides of pipelines by hydro-excavation prior to installing piles or shoring.

(b) Use of pneumatic concrete breakers within 5 metres of the Critical Water Infrastructure is prohibited. Pavement shall be full depth sawcut and carefully removed. Use of hand held jackhammers for pavement removal will be allowed.

(c) Utilize only smooth edged excavation buckets, soft excavation techniques where there is less than 1.5 m of earth cover over the Critical Water Infrastructure or 1.0 m in any direction. Where there is less than 1.0 m soil over above the Critical Water Infrastructure, provide full time supervision and complete the excavation utilizing hand excavation or soft excavation methods.

(d) Offset backhoe or excavation equipment from the Critical Water Infrastructure a minimum of 3 m from centerline to carry out excavations.

(e) Equipment should not be allowed to operate while positioned directly over the Critical Water Infrastructure except where permitted herein, outlined in the reviewed and accepted construction method statement.

(f) Excavations within 3 m of the outside edge of any Critical Water Infrastructure and which extend below obvert of the Critical Water Infrastructure shall utilize shoring methods that precludes the movement of in-situ soils (i.e. a tight shoring system).

(g) Pre-bore piles to below invert of Critical Water Infrastructure.

(h) Minimum offset from closest edge of piles or shoring to the Critical Water Infrastructure is 600 mm.

(i) Showing shall not impart lateral loads on pipelines.

(j) Excavation shall proceed evenly such that differential loads are not imparted on shoring or Critical Water Infrastructure. A maximum of 25 mm differential movement shall be immediately reported to the Contract Administrator.

(k) Removal of piles and/or sheeting shall be completed in a way to not result in lateral loading on the Critical Water Infrastructure.

(l) If Critical Water Infrastructure inspection is required, expose the top 1/3 of the Critical Water Infrastructure by hand excavation, for a minimum length of 1 metre, to allow City to inspect condition of the pipe. Notify City a minimum of 24 hours in advance of exposure and allow a minimum of 2 hours for City to complete inspection works. Backfill test excavation with bedding sand upon completion.

E16.7 Backfill

E16.7.1 Backfilling shall be completed without use of heavy vibratory compaction equipment or equipment that would impart excessive loads on pipes and joints. Small vibratory compaction equipment such as plate packers up to 350 kilograms will be permitted.

E16.7.2 Backfilling of shoring to the spring line of the adjacent Critical Water Infrastructure shall be with Cement-Stabilized Fill.

E16.8 Measurement and Payment

(a) Work covered in this section will be considered incidental and will not be measured for payment. No separate payment will be made.

E17. EXCAVATION AND BACKFILL

E17.1 Description

(a) In addition to CW 2030, This Specification shall cover the excavation and backfill requirements for the Works.

E17.1.1 Related Specifications:

(ii) Work in Proximity to Critical Water Infrastructure (E16)

(iii) Microtunnelling Shafts (E27)

E17.2 Submittals

(a) An excavation plan for deep excavations (greater than 3 m in depth) shall be prepared and submitted in accordance with E4 a minimum of ten (10) Business Days prior to undertaking the excavation and shoring installation. The excavation plan shall include the following:

(i) Shop Drawings for the shoring system, and where required by Workplace Safety and Health Regulation, shoring Shop Drawings shall be sealed by a Professional Engineer, registered in the Province of Manitoba, experienced in the design of excavation shoring systems.

(ii) Detailed excavation and shoring installation procedures.

(iii) Detailed backfill and shoring removal procedures.

(b) For additional submission requirements for Microtunnelling shafts, see E27.3.

(c) For additional submission requirements for the Discharge Chamber and 1350 Gravity Sewer, and St. Vital Trunk Connection Manhole and 1350 Gravity Sewer excavation and backfill, see E16.

E17.3 Construction Methods

E17.3.1 Construction in close proximity to Critical Water Infrastructure shall be completed in accordance with E16.

E17.3.2 Excavation

(a) The Contractor is responsible for locating the existing sewer and other buried utilities and shall take all steps to locate the existing sewer prior to excavation and installation of shoring.

(b) Materials shall not be stockpiled over pipelines.

(c) Materials shall not be stockpiled within 30 m of the river bank.

(d) Carefully excavate to expose existing pipelines.

(e) Only smooth edged buckets may be utilized for excavations within 1.5 m of the existing sewer.

(f) The existing sewer shall be located prior to proceeding with excavations within 1.0 m of the pipe. Final excavation (within 300 mm of the pipe wall) shall be completed using soft dig or hand excavation methods to prevent damage to the pipe.

(g) Excess excavation materials shall be disposed of off-site.

E17.3.3 Shoring Installation

(a) Piles (if used) shall be installed with a minimum of 500 mm of clear separation between the pile and the outside of the existing sewer wall.

(b) Piles (if used) shall be pre-bored to a depth below the invert of the sewer.

(c) Excavation and shoring installation shall not initiate movement or otherwise destabilize soils sounding the existing trunk sewers.

(d) Locate the extents of the existing sewer prior to pre boring and installing shoring using soft dig methods. Please note the wall thicknesses and outside diameter of the existing trunk sewers are based on the best record information available but actual wall thicknesses could vary from what's depicted on the drawings.

(e) Shoring shall be installed in such a manner as to preclude destabilization of adjacent soil and buildings.

E17.3.4 Shoring Removal

(a) Shoring systems shall be completely removed upon completion of the works except where noted.

(b) Care shall be taken to remove the shoring system and backfill the trench in such a way as to not create voids. If the shoring system requires removal after backfill is in place, resulting voids shall be filled with flowable cement slurry.

E17.3.5 Backfill

(a) Backfill within 1 m of existing and proposed pavements shall be completed to CW 2030, Class 1 standards. Granular Class 2 backfill shall extend to the underside of the stabilized fill.

(b) Backfill within 1 m of existing gravel driveways shall be completed to CW 2030, Class 2 standards.

(c) All other areas shall be backfilled with a Class 4 backfill unless otherwise noted on the Drawings.

(d) Backfilling with frozen materials will not be permitted except where Class 3 or Class 5 backfill has been specified.

E17.4 Measurement and Payment

E17.4.1 Excavation and backfill will be considered incidental to the Work and will not be measured for payment. No additional payment will be made.

E18. PIPELINE INSPECTION

E18.1 Description:

(a) This Specification describes the requirements for obtaining the pipeline inspections required for the Work.

E18.2 General

E18.2.1 The following SONAR pipeline inspection shall be undertaken:

(a) Post installation of the 914 mm DR 11 HDPE (carrier) siphon pipes.

E18.2.2 The following CCTV pipeline inspections shall be undertaken:

(a) Post installation of the two (2) 1350 mm RCP gravity sewers crossing Abinojii Mikanah.

(b) Post installation of the two (2) 450 mm RCP LDS.

(c) Pre and post rehabilitation of the 1350 mm gravity outfall.

E18.3 Submittals:

E18.3.1 Pipeline Inspections

(a) Submit pipeline inspections within five (5) Business Days of inspection.

E18.3.2 Sewer Inspection Reports

(a) Provide the Contract Administrator with the following sewer inspection reports prepared in accordance with CW 2145 with all inspections.

E18.4 Complete the Pipeline Inspection via CCTV or SONAR in accordance with CW 2145.

E18.5 Sewer Inspection Equipment

E18.5.1 Notwithstanding CW 2145, CCTV equipment meet the following requirements:

(a) Minimum requirements of the in-line inspection platform include:

(i) Independently controlled drive tracks that enable the platform to manoeuvre around bends and climb over debris up to 300mm in height.

(ii) Operable under partially or fully submerged flow conditions, for distances up to 500m upstream or downstream from a single access point.

(iii) Operable in sewers of various cross-sections and constructed of standard pipe materials including brick, concrete, PVC, HDPE, and steel.

(iv) Tethered to facilitate extraction of the platform from the sewer, without causing damage to the sewer infrastructure, in the event the equipment fails or otherwise becomes uncontrollable within the sewer.

(v) Equipped with sufficient high intensity lighting to illuminate the sewer for visual inspection.

(vi) Equipment shall be capable of continuously capturing digital video from first generation recordings with no frame loss, regardless of the progression of the inspection.

(vii) Equipment shall be used to acquire continuous digital video images of the sewer for the entire length being inspected.

E18.5.2 SONAR Inspections

(a) SONAR inspections may be utilized to complete the entirety or portions of the inspections identified in E18.2.

(b) Where SONAR inspections are employed, the pipeline shall be completely full of water to facilitate a complete inspection.

(c) The Contractor or SONAR inspection Sub-Contractor shall have qualified technicians on site or on call remotely for real time review and interpretation of the SONAR data.

(d) A SONAR inspection plan shall be submitted a minimum of twenty (20) Business Days prior to undertaking SONAR inspections. The SONAR inspection plan shall include the following:

(i) Identify SONAR crew (or Sub-Contractor).

(ii) Qualifications for on site SONAR technicians and data analysists working on the project. The SONAR inspection foreman and data analysist shall have a minimum of five (5) years of experience with pipeline SONAR inspections.

(iii) Proposed SONAR equipment.

(iv) Minimum winch capacity and tensile strength of cable for tool retrieval.

(v) Proposed extents of SONAR inspection.

(vi) Means of ensuring a full pipe through the SONAR inspection zone.

(vii) Sample preliminary SONAR report.

(viii) Sample final SONAR report. Include example SONAR results from an inspection within a steel pipeline of similar diameter.

(ix) Proposed inspection schedule, including mobilizations and demobilizations.

(e) SONAR inspection reporting:

(i) On site SONAR technicians shall report any anomalies or concerns related to the siphon immediately to the Contract Administrator.

(ii) A written preliminary report shall be submitted within 24 hrs of the SONAR inspection.

(iii) A final written report shall be submitted within fourteen (14) Calendar Days of the SONAR inspection.

E18.6 Methods

(a) Inspections shall occur in the presence of the Contract Administrator.

E18.7 Measurement and Payment

(a) The total length of inspection to be paid will be the total length of sewer inspected, using CCTV or SONAR inspection, to the satisfaction of the Contract Administrator for each identified inspection in “Pipeline Inspection”. Measurement will be made along the center line of the sewer from the nominal face of the chamber wall on either side of the river. Where partial or incomplete inspections are submitted, the length of sewer inspected will the length recorded by the Contractors calibrated inspection equipment or as determined by the Contract Administrator.

(b) Sewer inspection reports shall be considered incidental to “Pipeline Inspection”. Payment in the amount of 10% of the “Pipeline Inspection” shall be held back until satisfactory receipt for the sewer inspection report. No additional payment will be made.

(c) Payment will not be made for inspections re-performed where the Contract Administrator has determined the requirements of the specification have not been satisfied.

(d) Payment will only be made once per inspection regardless of duplication of inspection efforts.

E19. BUILDING INSPECTIONS AND VIBRATION MONITORING

E19.1 Description

(a) The work specified in this Section includes furnishing of vibration monitoring instrumentation to monitor vibrations on nearby structures caused by construction activities.

(b) Depending on the means and methods chosen by the Contractor, implementation of vibration monitoring may or may not be necessary. Implementation of vibration monitoring will be at the discretion of the Contract Administrator, to be determined following submission and review of the Contractor’s planned means and methods of executing the Work.

(c) The work executed under in this specification, if undertaken, shall include but not be limited to performing pre-construction surveys, supply and installation of vibration monitoring equipment, monitoring of vibration data, submission of vibration data and reports to the Contract Administrator, performing post-construction surveys, and abandonment of monitoring equipment.

(d) While a current by-law on acceptable vibrations does not exist for the City of Winnipeg, the monitoring data should be compared to the California Department of Transportation and Construction Vibration Guidance Manual (April 2020) which presents probabilistic damages thresholds.

E19.2 Submittals

(a) Upon request by the Contract Administrator, submit a Vibration Monitoring Plan in accordance with E4. The Vibration Monitoring Plan shall include, at a minimum:

(i) A description or sketch showing the proposed location for monitoring devices;

(ii) Make and model of vibration monitors to be installed;

(iii) Testing company contracted to perform the installation and monitoring;

(iv) Means and methods of collecting, storing and distributing vibration data; and

(v) Schedule for execution of the Work.

(b) Submit Shop Drawings for proposed vibration monitoring equipment in accordance with E4 and meeting the requirements as specified herein.

(c) Reports and Records:

(i) The Contractor shall submit all reports of monitoring data to the Contract Administrator on a daily basis.

(ii) Within 72 hours following installation of the instruments, submit drawings showing the actual as-built installed location, the instrument identification number, the instrument type, and the installation date and time.

(iii) Submit pre and post construction surveys in accordance with E19.4(a), including photographs, video (as needed), field notes, and sketches. Surveys should provide a record of foundation, interior walls, door and window frames, existing cracks or other pre-existing damage, and any other relevant features.

(iv) The collected data shall be made available and be provided to the homeowners or business owners adjacent to the work upon request.

E19.3 Quality Control

(a) Vibration monitoring shall be installed and performed by a suitable testing company with previous experience in performing related work.

E19.4 Construction

(a) Building Inspection

(i) The Contractor or their designate shall complete a pre-construction photographic survey of the existing structures adjacent to the work.

- The pre-construction survey should provide a record of foundation, interior walls, door and window frames, existing cracks or pre-existing damage, and any other relevant features.
- Pre-construction surveys shall be conducted in the presence of the Contract Administrator prior to commencement of construction activities.

(ii) Where the Contractor is entering properties to undertake the photographic survey, notices shall be provided to the businesses or homeowners in advance to arrange for interior inspections. Notices shall be reviewed and accepted by the Contract Administrator and the City prior to issuance.

- Where homeowners of businesses will not permit access to structures for inspection, the Contractor shall duly document attempts to arrange

access. Inspections, insofar as possible shall be made from public right-of-way, noting any visual defects observed.

(iii) Following construction activities, the Contractor shall arrange for a post construction inspection of any business or residences where pre-construction inspections were undertaken. The post construction inspection shall be conducted in the presence of the Contract Administrator.

(b) Instrumentation

(i) Monitoring instruments shall be installed on structures at nearest point to the proposed shaft locations.

(ii) Vibration monitors shall meet or exceed the following requirements:

- Capable of measuring 0 – 400 mm/sec, continuously.
- Capable of continuously recording monitoring data. Download data periodically as required by storage requirements.

(iii) Vibration monitoring shall be installed prior to commencement of construction activities identified as requiring vibration monitoring. Obtain baseline measurements for five (5) consecutive days prior to commencement of construction activities identified as requiring vibration monitoring.

E19.5 Remove monitoring instrumentation upon completion of work identified as requiring vibration monitoring.

E19.6 Measurement and Payment (Provisional Item)

(a) Building inspections as specified herein will be measured on a Unit Price basis as listed in Form B: Prices. Payment will be made at the Contract Price for “Building Inspection and Vibration Monitoring”. Payment shall include but not be limited to the performance of pre-construction and post-construction surveys.

(b) Vibration monitoring as specified herein will be measured on a Unit Price basis as listed in Form B: Prices. Payment will be made at the Contract Price for “Building Inspection and Vibration Monitoring”. Payment shall include but not be limited to the supply, installation and protection of the instruments, performance of baseline measurements, ongoing monitoring, submission of data, and abandoning of the instruments.

(c) Payment for vibration monitoring will be made on the following schedule:

(i) Twenty five percent (25%) of the Unit Price will be paid following the completion of the installation of the instrumentation and provision of baseline measurements.

(ii) The remaining seventy five percent (75%) will be paid upon completion of the monitoring program as specified herein.

TRAFFIC CONTROL AND SAFETY

E20. TRAFFIC CONTROL

E20.1 In accordance with the Manual of Temporary Traffic Control on City Streets (MTTC), the Contract Administrator shall make arrangements with the Traffic Services Branch of the City of Winnipeg to place, maintain, and remove all regulatory signs and traffic control devices authorized and/or required by the Traffic Management Branch in the following situations:

(a) Parking restrictions,

(b) Stopping restrictions,

(c) Turn restrictions,

(d) Full or directional closures on a Regional Street, and

(e) Approved Designated Construction Zones with a temporary posted speed limit reduction. Traffic Services will be responsible for placing all of the advance signs and 'Construction Ends' (TC-4) signs. The Contractor is still responsible for all other temporary traffic control including but not limited to barricades, barrels and tall cones.

E20.2 Further to E20.1 the Contractor shall make arrangement with the Traffic Services Branch of the City of Winnipeg to supply regulatory signs as required.

E20.3 Upon request from the Contract Administrator, the Contractor shall provide records demonstrating that the Site has been maintained.

E20.4 Further to E20.1 the Contractor shall make arrangements with the Traffic Services Branch of the City of Winnipeg to reinstall the permanent regulatory signs after the Contract Work is complete. At this time the Contractor shall make arrangements to drop off the stockpiled materials to Traffic Services at 495 Archibald Street.

E20.5 Any changes to the approved traffic management plan must be submitted to the Contract Administrator a minimum of (five) 5 Working Days prior to the required change for approval.

E20.6 If the Contract Administrator determines that the Contractor is not performing Traffic Control in accordance with this specification, Traffic Services Branch may be engaged to perform the Traffic Control. In this event the Contractor shall bear the costs associated charged to the project by the Traffic Services Branch of the City of Winnipeg in connection with the required Works undertaken by the Contractor.

E21. PEDESTRIAN ACCESS

E21.1 Description

(a) This Specification shall govern the requirements for maintaining pedestrian access during the course of the Work.

E21.2 Further to Section 3.6 of CW 1130 of the General Requirements, the Contractor shall maintain safe pedestrian crossings 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.

E21.3 Further to E21.2, the Contractor shall maintain pedestrian access through the following locations:

(a) East Side Laydown Area:

(i) Pedestrian access shall be maintained along all multiuse paths on the East side of the river along Abinojii Mikanah as shown on the Drawings.

(ii) A temporary multiuse path shall be constructed along the southern edge of the Abinojii Mikanah pathway as shown on Drawings. Contractor to take care that drainage from adjacent property is maintained through the site at all times.

(iii) Supply and install 68x13 mm corrugated, 2 mm thick, galvanized steel culvert as per CW 3610.

(iv) Restoration in accordance with E50.

(b) West Side Laydown Area – Pedestrian access shall be maintained along all multiuse paths on the West side of the river along Abinojii Mikanah as shown on the Drawings.

(c) Where construction activities block pedestrian access across the multiuse pathways, the Contractor shall provide flag persons to safely escort pedestrians across the mulituse pathway.

E21.4 The Contractor shall ensure any roadways crossing the multiuse paths are clear from mud, snow, and debris at all times during construction.

E21.5 Measurement and Payment

(a) Maintaining pedestrian access as outlined herein will be considered incidental to the work and will not be measured for payment. No separate payment will be made.

(b) Construction of the temporary mulituse path at the East Side Laydown Area shall be paid for under the Lump Sum price in "East Side Laydown Area – Temporary Mulituse Pathway", and shall include excavation, grading, and installation of geotextile fabric, sub-base, base, asphalt and any other works required in the construction of the temporary multiuse path.

(c) Supply and installation of CSP culvert shall be measured on a linear basis and paid for at the Contract Unit Price for "Supply and Install of 300mm CSP Culvert".

(d) Restoration of the permanent mulituse path and removal of the temporary mulituse pathway at the East Side Laydown Area shall be paid for separately in accordance with E50.

GENERAL STRUCTURAL

E22. PLASTIC FABRICATION

E22.1 Description

(a) Supply and installation of fibreglass reinforced plastic (FRP) support members, grating and accessories.

E22.2 Submittals

(a) Provide shop drawings in accordance with E4.

(b) Design of the (FRP) structural support members, grating and accessories shall be performed by a Professional Engineer registered in the Province of Manitoba (Contractor's Engineer). The Contractor's Engineer doing the design shall review the in-place installation and certify in writing that the work is in conformance with her/his design.

(i) Grated hatches to be cut to suit opening complete with a hinge and lifting handle.

(ii) Use loads, load combinations, and stress levels for design in accordance with the National Building Code of Canada (NBCC) 2020 and Manitoba Amendments.

(iii) Loads:

- Live Load: Minimum 1 kPa
- Dead Load: 0.5 kPa
- Point Load: Minimum 250 kg (at location of knife gate valve operator only)

(c) Include erection drawings, elevations, and details.

(d) Submit one (1) sample of each type of grating.

E22.3 Quality Assurance

(a) The installation Contractor shall be an erector approved by the Manufacturer.

E22.4 Delivery, Storage and Handling

(a) Manufactured materials shall be delivered stored and handled in accordance with Manufacturer's instructions.

E22.5 Materials

(a) Grating: Acceptable product Fibergrate Vi-Corr by Fibergrate Composite Structures Inc., colour dark gray, top surface: Applied Grit Top.

(b) FRP support members: Dynaform in VEFR vinyl ester resin by Fibergrate Composite Structures Inc., colour dark gray.

(c) FRP Angle: EZ Angle by Fibergrate Composite Structures Inc., colour dark gray.

(d) Hold-down clips: stainless steel.

E22.6 Construction Methods

(a) Examination

(i) Before starting erection, examine other Work that may affect this Work.

(ii) Notify the Contract Administrator of any conditions that would prejudice proper installation of this Work.

(iii) Commencement of erection Work implies acceptance of existing conditions.

(b) FRP Installation

(i) FRP products shall be installed in accordance with Manufacturer's Shop Drawings and written instructions.

(ii) The Contractor shall verify measurements in field for the Work prior to FRP fabrication. Determine correct size and locations of required holes or cut-outs from field dimensions before fabrication.

(iii) Fabricate and install grating panels such that adjacent panels have perpendicular bars lining up to present a continuous appearance. Clip panels together to prevent differential panel to panel movement.

(iv) Gratings shall be fabricated free from warps, twists, or other defects that affect appearance and serviceability.

(v) Hold-down clips shall be provided and spaced with a minimum of four per piece of grating, or as recommended by the Manufacturer. Hold-down clips and related appurtenances shall be stainless steel.

(vi) All cuts and abrasions are to be sealed in accordance with the FRP Manufacturer's written instructions.

(vii) Gratings shall have removable slots to allow for safe installation of stop logs from grating.

E22.7 Measurement and Payment

(a) Supply and installation of fabricated plastic components will not be measured for payment. Plastic fabrications will be considered incidental to the Lump Sum Price for "Construction of Siphon Chambers". No separate measurement or payment will be made.

E23. METAL FABRICATIONS

E23.1 Description

(a) This Specification shall cover the supply and installation of metal piping, support members, grating, and accessories.

E23.2 Materials

(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, and with sharply defined profiles.

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

(d) Steel Pipe: to ASTM A53/A53M, seamless, galvanized, as specified on the Drawings.

(e) Welding materials: to CSA W59.

(f) Hot dipped galvanized steel repair material: Galvalloy and Gal-Viz.

(g) Stud Anchors: to ASTM A108, Grade 1020.

(h) Aluminum: to CAN/CSA S157 and the Aluminum Association 'Specifications for Aluminum Structures'. Aluminum for plates shall be Type 6061-T651. Aluminum plate shall have an approved raised oval or multi-grip pattern.

(i) Isolating sleeves shall be "Nylite" – headed sleeve as manufactured by SPAE-Naur, or approved equal in Accordance with B7.

(j) Anchor bolts and fasteners: 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.

E23.3 Construction Methods

(a) Shop Drawings

(i) Submit Shop Drawings in accordance with E4.

(ii) Clearly indicate profiles, sizes, connections, attachments, reinforcing, anchorage and size and type of fasteners and accessories.

(iii) Include erection drawings, elevations and details where applicable.

(iv) Indicate welded connections using CISC standard welding symbols. Clearly indicate net weld lengths.

(v) Submit qualifications of the fabricator and welders.

(vi) Shop Drawings and design briefs are to bear the seal of a Professional Engineer registered in the Province of Manitoba.

(b) Fabrication

(i) 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.

(ii) Confirm measurements for all fabrications before fabricating.

(iii) Cut aluminum plate with edges straight and true, and as far as practical, maintain continuity of the pattern at abutting edges.

(iv) Pieces shall be of the sizes indicated on the Drawings and shall not be built up from scrap pieces. Confirm sizes with field measurements.

(v) Where possible, fit Work and shop assemble, ready for erection.

(vi) Remove and grind smooth burrs, filings, sharp protrusions, and projections from metal fabrications to prevent possible injury.

(vii) All steel welding shall conform to CSA Standard W.59. Fabricator shall be fully approved by the Canadian Welding Bureau, in conformance with CSA Standard W.47.1. Welding shall be done by currently licensed welders only.

(viii) All aluminum welding shall be in accordance with the requirements of CSA W59.2. The fabricator shall be fully certified in conformance with CSA Standard W47.2. All welding shall be done in a licensed welding shop, and no field welding will be permitted unless approved in writing, in advance, by the Contract Administrator.

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

(x) All steel shall be hot-dip galvanizing after fabrication, in accordance with CAN/CSA G164, to a minimum net retention of 600 gm/m^2.

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

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

(c) Erection

(i) Do steel welding Work in accordance with CSA W59 and aluminum welding Work in accordance with CSA W59.2

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

(iii) 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.

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

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

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

(vii) 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 177ºC (350ºF) at all times. All heating of structural steel. Work shall be done in the presence of the Contract Administrator.

(viii) 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.

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

(x) Install electrochemical isolation gaskets and sleeves to electrically isolate dissimilar metals.

E23.4 Measurement and Payment

(a) Supply and installation of fabricated metal components within the Siphon Chambers will not be measured for payment. Metal fabrications will be considered incidental to the Lump Sum Price for “Construction of Siphon Chambers”. No separate measurement or payment will be made.

(b) Supply and installation of fabricated metal components within the Discharge Chamber will not be measured for payment. Metal fabrications will be considered incidental to the Lump Sum Price for “Construction of Discharge Chamber”. No separate measurement or payment will be made.

E24. CAST-IN-PLACE CONCRETE

E24.1 Description

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

E24.2 Materials

(a) Structural Concrete Mix Design

(i) Provide concrete mixed in accordance with requirements of CAN/CSA-A23.2.

(ii) Structural concrete design shall be in accordance with performance specification having the following properties:

- Class of Exposure: S-1
- Minimum Compressive Strength @ 28 days: 35 MPa

(b) Lean-Mix Concrete Design

(i) Lean-mix concrete design shall be in accordance with performance specification having the following properties:

- Cement: Type HS
- Minimum Compressive Strength @ 28 days: 15 MPa

(c) Flowable Cement Stabilized Fill

(i) Flowable Cement Stabilized Fill design shall be in accordance with performance specification having the following properties:

- Cement: Type GUL
- Minimum Compressive Strength @ 28 days: 1.5-2.5 MPa

(d) Bonding Agent

(i) Bonding agent shall be ACRYL-STIX or approved equal in accordance with B7.

(e) Waterstop

(i) Waterstop shall be 152.4mm wide by 9.5mm thick Vinylex ribbed center bulb or approved equal in accordance with B7.

E24.3 Construction Methods

E24.3.1 Construction Method Submission

(a) No Work shall commence on construction of valve chamber until after the Contract Administrator's review of the Contractor's Construction Method submission.

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

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

- The Contractor shall be aware of the proximity to the Branch II Aqueduct and the Fort Garry-St. Vital Feeder Main, and plan Work in the vicinity thereof in accordance with E16.

(ii) Proposed method of construction.

(iii) Specialized equipment to be used.

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

(v) Flow control considerations including details on the Contractor's proposed method of flow control.

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

E24.4 Cast-in-Place Concrete Construction

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

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

E24.5 Measurement and Payment

(a) Supply and installation of Cast-in-Place Concrete within the Siphon Chambers will not be measured for payment. Cast-in-Place Concrete will be considered incidental to the Lump Sum Price for "Construction of Siphon Chambers". No separate measurement or payment will be made.

(b) Supply and installation of Cast-in-Place Concrete within the Discharge Chamber will not be measured for payment. Cast-in-Place Concrete will be considered incidental to the Lump Sum Price for "Construction of Discharge Chamber". No separate measurement or payment will be made.

E25. REINFORCING STEEL

E25.1 Description

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

E25.2 Materials

E25.2.1 Reinforcing Steel

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

E25.2.2 Bar Accessories

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

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

E25.3 Construction Methods

E25.3.1 Placing of Reinforcing Steel

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

(b) Splices in reinforcing steel shall be made only where indicated on the Contract Drawings. Prior acceptance of the Contract Administrator shall be obtained where, in the opinion of the Contractor, other splices must be made. All splices shall have Class 'B' top lap splices in accordance with Reinforcing Steel Manual of Standard Practice. Welded splices shall not be used.

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

E25.3.2 Quality Control

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

E25.3.3 Shop Drawings

(a) The Contractor shall submit shop drawings in accordance with E4 for the Contract Administrator's review two (2) weeks prior to the fabrication of any reinforcing steel.

E25.4 Measurement and Payment

(a) Supply and installation of Reinforcing Steel within the Siphon Chambers will not be measured for payment. Reinforcing Steel will be considered incidental to the Lump Sum Price for "Construction of Siphon Chambers". No separate measurement or payment will be made.

(b) Supply and installation of Reinforcing Steel within the Discharge Chamber will not be measured for payment. Reinforcing Steel will be considered incidental to the Lump Sum Price for "Construction of Discharge Chamber". No separate measurement or payment will be made.

E26. CONCRETE PROTECTIVE LINERS

E26.1 Description

(a) This Specification shall cover the protective liner requirements for:

(i) Cast-in Place Discharge Chamber

(ii) Cast-in-Place Siphon Chambers in wet cell only

(iii) Two (2) 1350 mm Gravity Sewers

(iv) 2400 mm Manhole Connection to the St. Vital Trunk

E26.2 Submittals

(a) Submittals to be in accordance with E4.

(b) Product information on liner material, including: material properties, liner installation procedures, welding instructions, testing methods, and future repair procedures.

(c) Provide information on closure details and methods, at minimum:

(i) Pipe Entries
(ii) Hatches
(iii) Joints
(iv) Corners
(v) Flap Gates
(vi) Stop Logs
(vii) Ladder brackets

(d) Documentary evidence of the liner installer's experience on similar installations. All welders shall be trained and certified by the liner manufacturer or manufacturers approved representative.

(e) Holiday test results from pipe and chamber liners. Reporting of holiday test results shall include reference to individual pipes, seams and installed location.

E26.3 Quality Control

(a) All lining materials shall be factory checked electrically to ensure freedom from pinholes, porosity, and imperfections.

(b) Lining installers shall be trained and approved by the liner manufacturer and have at least five (5) years of experience with the installation with the installation of the relevant lining product.

(c) The welding supervisor shall have a minimum of three (3) years of experience in welding plastic liners. All welders shall have a minimum of one (1) year of experience in welding plastic liners.

E26.4 Materials

(a) Liner shall have integral locking extensions. The lining shall be mechanically and permanently imbedded in the concrete. Liner material shall be impermeable to sewage gasses and liquids and shall not promote bacterial or fungal growth.

(b) Once installed, the liner shall make a continuous impermeable barrier from sewer gases, inclusive of the interior of all pipes, walls, slabs, pipe entries, hatches and other structure appurtenances with exposed concrete. Grouted chambers floors do not require lining, but the liner shall be sealed tight to prevent sewage or sewage gas from travelling behind the liner.

(c) The liner shall be manufactured from virgin High Density Polyethylene (HDPE) resins.

(d) Liner shall have an elongation sufficient to bridge up to 6 mm cracks which may occur in the structure or joint after installation, without damage to the lining. The lining shall be repairable at any time during the life of the structure.

(e) HDPE liner material shall have a minimum tensile capacity of 14.5 MPa.

(f) Anchor studs shall be a minimum of 13 mm tall with a minimum of 420 studs per m2.

(g) The liner shall have a minimum thickness of 2.00 mm.

(h) Approved Products:

(i) Ultra-Grip, manufactured by Agru America Inc.
(ii) Solmax (previously GSE) Studliner, manufactured by Solmax.

E26.5 Testing

(a) Liners on each pipe shall be holiday tested prior to leaving the production plant.

(i) Results of the holiday testing shall be recorded and submitted to the Contract Administrator in accordance with E4.

(ii) All lined surfaces including welds shall be tested for holidays and flaws using an electrical holiday detector as per the liner manufactures recommendations.

(iii) Holiday testing shall be performed by the Contractor in the presence of an independent testing agency and the Contract Administrator. Notify the Contract Administrator and the independent testing agency at minimum of forty-eight (48) hours in advance of test schedule.

(b) Areas of liner that are damaged or otherwise fail to meet the field tests shall be repaired as recommended by the liner manufacturer and retested.

(i) After the installation of the pipe and completion of all field welds and repairs the surface of the liner shall be cleaned to permit visual inspection.

(ii) After completion of the welding the entire interior surface shall be tested with an electrical holiday detector as per the liner manufactures recommendations.

(iii) All welds shall be probed with a dull putty knife to test the bond of weld strips.

(iv) Areas of liner that are damaged or otherwise fail to meet the field tests shall be repaired as recommended by the liner manufacturer and retested.

E26.6 Delivery, Storage, and Handling

(a) Delivery and Acceptance Requirements: deliver Materials to site in original factory packaging, labelled with manufacturer's name and address.

(b) Storage and Handling Requirements:

(i) Store Material in accordance with manufacturer's recommendations.

(ii) Store and protect Materials from damage.

(iii) Replace defective or damaged Materials with new.

E26.7 Field Welding and Liner Repairs

(a) All workmanship shall be first class in accordance with best field practices.

(b) All workers shall wear rubber or other suitable soft shoes which will not damage the liner.

(c) Joints:

(i) Either of the following joint types may be used for joining liner sections at pipe joints after installation of the concrete pipe.

(ii) Joint Type 1:

- Type 1 joints shall be made with a separate joint strip and two welding strips. The joint strip shall be centered over the joint and welded along each edge to adjacent sheets with a 25 mm wide welding strip. The joint strip shall lap over each sheet a minimum of 38 mm.

(iii) Joint Type 2:

- Type 2 joints shall be made by lapping sheets not less than 38 mm and welding with a 25 mm welding strip on both faces of the joint. The upstream sheet shall overlap the downstream sheet. The overlap shall not exceed 100 mm.

(d) Repairs:

(i) All damage to the liner during the installation process shall be repaired in as per the liner manufactures recommendations.

(ii) 25 mm weld strips may be used for cuts in the liner.

(iii) Holes and other damage shall be repaired with patches. All patches shall overlap a minimum of 38 mm onto undamaged liner material.

(e) Welding:

(i) Installation of the lining, including preheating of sheets in cold weather and the welding of all joints, shall be performed in strict conformance with the specifications, instructions, and recommendations of the liner manufacturer.

(ii) Liner material used for repairs and joint welds shall be of equal or greater thickness to the liner product.

(iii) All weld surfaces shall be free from water, dirt, grease, paint, oil, cement and any other foreign material. Weld surfaces shall be cleaned thoroughly immediately before welding using a cleaning product approved by the liner manufacturer. HPPE weld surfaces shall be roughened using a scraper knife to remove the gloss or oxidation and shall be uniform and free from tears, fins, and other defects which adversely affect proper welding.

(iv) No welding shall take place on liners that are at different temperatures. The Contractors shall not weld the liners until twenty-four (24) hours after the pipe has been installed and backfilled, allowing for liner and pipe temperatures to stabilize.

(v) All welds shall produce complete fusion of the parent material and shall be free from unsound material such as porosity, cracks, and burns. Incomplete fusion and charred or blistered welds will be rejected.

(vi) Center welding strips over the clean surfaces to be joined and fuse across its entire width.

(vii) Hot joint compounds, such as coal tar, shall not be applied to the lining.

E26.8 Measurement and Payment

(a) Supply and installation of concrete protective liners will be paid for under the Lump Sum Price for “Concrete Protective Liners”, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

(b) Supply and installation of concrete protectives lines for the 1350 mm Gravity Sewers will be considered incidental to “1350 mm C76-V RCP complete with Concrete Protective Liners” as listed in Form B:Prices. No additional measurement or payment will be made.

(c) Payment in the amount of 10% of the “Concrete Protective Liners” shall be held back until satisfactory receipt of post-installation holiday testing results. No additional payment will be made.

RIVER CROSSING SHAFT AND TUNNELLING CONSTRUCTION

E27. MICROTUNNELLING SHAFTS

E27.1 Description

E27.1.1 This Section includes excavation and initial support of shafts, including launch shafts and receiving shafts for Microtunnelling.

E27.2 General

E27.2.1 Performance Requirements

(a) Select methods of shaft excavation and initial ground support that are compatible with conditions described in the Geotechnical Baseline Report, and with requirements for placement of permanent structures, control of water, safety of personnel, and protection of adjacent property.

(b) Initial ground support systems shall maintain the safety of personnel, prevent damage to adjacent property, and maintain the inherent strength and stability of ground surrounding the excavation. Initial ground support systems shall prevent ground loading on the new Work until after design strength has been reached.

(c) Specific methods of initial ground support and groundwater control required in this Section or shown on the Drawings are to be considered minimum requirements. Contractor is solely responsible for any additional construction measures necessary to

achieve the requirements of this Section, and is solely responsible for any damages resulting from failure to meet the requirements of this Section.

(d) Establish the size and configuration of shaft excavation to accommodate means and methods of construction, subject to minimum requirements and to any limitations shown on the Drawings and Specifications.

(e) Construction of shafts in addition to those shown on the Drawings, or in locations other than those shown on the Drawings, at the request of and for the convenience of Contractor, is subject to review and acceptance by the Contract Administrator.

(f) Should the Contractor be allowed to relocate a shaft from the position shown on the Drawings, any increase in the cost of relocating utilities above the estimated cost at the location shown on the Drawings, as determined by the Contract Administrator, shall be borne by the Contractor.

E27.2.2 Initial Ground Support System Design by Contractor

(a) Contractor shall be solely responsible for design of initial ground support systems, and for any revision of designs shown.

(b) Initial ground support systems should be designed to the recommended ground loads and surcharge loads provided in the Geotechnical Baseline Report. Contractor shall verify that ground loads and surcharge loads for design are adequate for the expected ground conditions, and are appropriate for the type of support system proposed. Contractor shall add construction loads appropriate to the means and methods of construction.

(c) Design of the initial ground support system shall consider:

(i) Ground conditions described in the Geotechnical Baseline Report.

(ii) Methods for control of water.

(iii) Maintenance of soil stability at the bottom of the excavation.

(iv) Deformation of the support system under load.

(v) The proximity of existing underground and above-ground structures, including buried water lines and the potential effect of their rupture on the support system.

(vi) Effects of vibration on adjacent structures, from driving and pulling sheeting and piling.

(vii) All loading conditions, including loading due to delay in adding support members, removal of support members, and dynamic loading.

(viii) Tunnel break-in and break-out procedures.

(ix) Placement of permanent lining and structures.

(x) Site and environmental conditions.

(d) Additional requirements for initial ground support systems for shaft excavations are shown on the Drawings.

E27.2.3 Accommodation of Microtunnelling Work

(a) The shafts used for launching and receiving shall be made fully adequate for the microtunnelling and trenchless work. Contractor shall be responsible for providing each launching shaft and each receiving shaft with all of the provisions necessary to perform the microtunnelling and trenchless operations. Furnish all labor, equipment, material, and additional design, as necessary, to meet the minimum requirements as contained herein.

(b) Contractor shall provide each launch shaft with thrust blocks, entrance seals, base slabs, pumping and drainage systems, ventilation systems, electrical systems, and lighting systems. Contractor's Engineer shall design the thrust blocks, entrance seals, and base slabs including any necessary modifications to the shoring. Contractor's Engineer shall also be responsible for developing a Fluid Control Plan to be

implemented by Contractor at each of the launching shaft sites in accordance with the requirements as contained herein.

(c) Contractor shall provide each receiving shaft with exit seals, working floors, and, as necessary, a pumping and drainage system to maintain dry working conditions. Contractor's Engineer shall design the exit seals including any necessary modifications to the shoring.

(d) Prevent the inflow of ground and/or groundwater into the shafts during the microtunnelling and trenchless operations including but not limited to break-in and break-out of the shaft during the launching and receiving processes. The ground shall be improved, as necessary, to prevent any inflow of ground and/or groundwater in excess of specified tolerances as contained herein.

(e) Prevent the machine from sinking or otherwise veering off of the alignment during the launching and/or receiving process. The ground shall be improved, as necessary, to prevent the machine from deviating along line and grade during the launching and receiving process in excess of the specified tolerances as contained herein.

(f) Contractor shall be responsible for ensuring that each of the shafts, including any modifications, used with the microtunnelling and trenchless operations is fully adequate for installation of the structures as shown on the Drawings. Contractor shall modify these shafts as necessary to accommodate the construction of these structures. Furthermore, Contractor's Engineer shall provide any additional design necessary for completing this work.

(g) Contractor shall be responsible for conditions as defined in the Geotechnical Baseline Report.

(h) Contractor shall store, process, transport, and dispose of any muck and/or excavated material in accordance with E29.

E27.2.4 Experience Requirements

(a) Contractor's Engineer shall be licensed by the Province of Manitoba with at-least five (5) years of experience designing microtunnelling and trenchless shafts.

(b) The Qualified surveyor shall have at least five (5) years of surveying experience involving tunnel works.

E27.3 Submissions

E27.3.1 Chamber Installation Plan

(a) The Contractor shall submit a construction shaft plan to the Contract Administrator a minimum of ten (10) Business Days prior to commencement of shaft construction works. If changes are made to the installation plan during construction, the Contractor shall submit these changes to the Contract Administrator for review in advance of implementation of the changes. The construction shaft plan shall include the following:

(i) Shop Drawings, in accordance with E4, showing the shaft construction. Shop Drawings shall be sealed by a Professional Engineer registered to practice engineering in the Province of Manitoba and experienced in the design of shoring systems. Shop Drawings shall include the following minimum information:

- Dimensioned layout of support system including location of members (such as caissons, beams, columns, piles, walers, struts, sheeting and other supports);
- Member sizes and thickness, and bending tolerances of structural steel;
- Quality of materials to be used (by reference to recognized standards such as ASTM), including but not limited to timber structural members, sheeting, and blocking; steel structural members, sheeting, plates, and bars; concrete; and grout;
- Connection details;

- Maximum allowable spacing between bracing points on compression members to maintain stability and alignment;
- Requirements or limits on pre-loading braces;
- Sequence of erection and removal;
- Design loading conditions;
- Codes and reference standards used as a basis for design;
- Location, dimensions, and means of ensuring stability at openings;
- For initial support members installed in advance of excavation, describe methods of installation, of quality control, and of correcting support system defects exposed by subsequent excavation;
- Existing utilities with separation distances;
- Means of accommodating microtunnelling and connection pipe installation;
- Means of accommodating construction of the final chambers and appurtenances;
- Where shafts are to form part of the final chamber, include sufficient details to demonstrate that the shafts meet the reinforcing requirements and design intent identified on the drawings and herein;
- Where shafts are to act as forming for the final chamber, include sufficient details to demonstrate the ability to accommodate final chamber construction; and
- Any other details required to demonstrate the proposed shafts meet the requirements of the microtunnelling work and associated piping and chamber construction works.

(ii) Shaft Excavation Plan, including the following information:

- Limits of shaft work sites.
- Location and dimensions of shaft excavations.
- Methods of excavation.
- Means of maintaining soil stability at the bottom of the shaft.
- Provisions for ventilating the excavation to prevent accumulations of hazardous gas.
- Measures employed at tunnel entry and exit points to stabilize the ground and to control groundwater.
- Site and shaft security arrangements.

(iii) Designers qualifications;

(iv) Sketch or sketches of the site clearing showing shafts, microtunnelling and other equipment necessary to complete the Work;

(v) Dimensions for all swales and ditches to be used to control surface water;

(vi) Monitoring and maintenance plan including Contractor's designated contact person responsible for dewatering and drainage, inspection intervals and means for supervising and monitoring pumping activity;

(vii) Pump sizes, power source, and noise attenuation features; and

(viii) Any other related information reasonably requested by the Contract Administrator.

(b) Submit samples, certifications, and test results of imported shaft bottom preparation materials, geotextiles, and backfill materials.

(c) Coordinate the submittal requirements of this Section with submittals required under other Sections for control of water, and for backfill grouting.

E27.3.2 Fluid Control Plan

(a) Fluid Control Plan to ensure that the equipment operator maintains full control over fluid volumes and fluid pressures during microtunnelling and trenchless operations including slurries and/or lubricants. Contractor shall determine the construction activities at each launch shaft site location and describe these in detail. Contractor's Engineer shall evaluate these activities and develop a plan including recommendations to ensure that fluid control is not impeded to any degree by any construction activity occurring at the site including but not limited to backfilling operations, leakage in the shoring, dewatering activities, and induced flow of groundwater. Consideration shall be given to the ground and groundwater conditions as defined in the GBR.

E27.3.3 Shaft Layout and Details

(a) For each microtunnelling and trenchless shaft, provide complete details, drawings, and schematics, as applicable. Show layout of shaft, including equipment, drawn to scale. Demonstrate that proposed layout of shafts is adequate for sequence of construction, equipment operations, and means and methods of pipe installation including any required acceptance testing. Describe in detail provisions for the working slab, invert treatment, and pump and drainage systems. Include details of lighting, ventilation, hydraulic, and electrical systems.

E27.4 Materials

E27.4.1 General

(a) Materials shall be selected by the Contractor to meet the performance requirements of the shoring system.

(b) Incorporation of used prefabricated elements into initial support systems is permitted, provided the strength and stability of used elements is verified prior to incorporation, and allowances made for lost strengths, if any, due to existing damage or deterioration.

(c) Any portions of the shoring system that are to act as the final structure shall meet all of the requirements identified on the Drawings and Specifications.

E27.5 Construction

E27.5.1 General

(a) Do not begin work on any of the microtunnelling and trenchless shafts until all relevant submittals have been reviewed and accepted by the Contract Administrator.

(b) Furnish all necessary labor, material, equipment, power, water, and utilities to complete the work. Additionally:

(i) Select the means and methods for performing the work.

(ii) Select, design, and install the thrust blocks. The thrust blocks shall be sufficiently reinforced, isolated, and otherwise anchored, to include any necessary ground improvement measures, to prevent movement from occurring within the launching shaft and/or misalignment of the jacking frame.

(iii) Select, design, and install the entrance seals, including any necessary modifications to the shoring, for the launching shafts.

(iv) Select, design, and install the base slabs, including any necessary modifications to the shoring, for the launching shafts.

(v) Select, design, and install the exit seals, including any necessary modifications to the shoring, for the receiving shafts.

(c) Damaged and/or deficient materials shall be repaired and/or replaced as directed by Contract Administrator.

(d) Protect from damage all of the existing improvements at the site including but not limited to structures, utilities, and culverts.

(e) Perform work in accordance with the reviewed submittals.

(f) The Contractor's surveyor shall be responsible for verifying any control points identified in the Contract Documents. Contractor's surveyor shall check any baseline and/or benchmarks shown prior to starting and report any errors or discrepancies to Contract Administrator.

(g) Notify the Contract Administrator immediately upon detecting any larger than predicted deformation, distress, or damage to the excavation support system.

(h) Notify the Contract Administrator immediately of any structural element that is not in accordance with the reviewed design submittals.

(i) Do not resume construction activities until corrective measures have been fully implemented.

E27.5.2 Groundwater Dewatering

(a) The contractor shall not undertake groundwater dewatering or otherwise effect a drawdown of existing groundwater levels or the underlying aquifer for facilitation of microtunnelling shaft construction or microtunnelling works.

(b) Microtunnelling works shall be undertaken utilizing sealed shafts to prevent the intrusion of ground water and lowering of existing groundwater levels.

(c) If required, the Contractor shall conduct a hydrogeological assessment to be used in conjunction with GDR and GBR for developing shaft construction methodologies.

(d) Dewatering of shafts and excavations that do not affect aquifer ground water levels such as seepage from overburden soils, silt and sand seams in overburden soils, or existing trench bedding and backfill will be permitted.

E27.5.3 Surface and Groundwater

(a) Inflow of Ground and Groundwater: If the groundwater is mixed with any slurry and/or lubricant, it shall be prevented from entering the shaft in accordance with Fluid Control Plan.

(b) Control water within excavations to prevent flowing conditions in silty and sandy soils, piping of fine soils, and softening and deterioration of shale bedrock.

(c) Prevent piping and loss of fines from the surrounding soils.

(d) Contractor to utilize appropriate measures such as advance ground treatment and/or adequate wall toe-in depths to prevent the possibility of base heave or soil piping.

(e) Take appropriate measures to prevent flooding of the shaft during periods of rainfall or overland flood.

(f) Prevent ice formation on shaft walls by groundwater cut-off, frequent scaling, heating of ventilation air, or other measures as necessary to eliminate the hazard of falling ice.

(g) The Contractor is responsible for the control, diversion, storage and pumping of all water including without limitation rain, snow melt, groundwater, leaking infrastructure and water in pipes throughout all stages of the Work.

(h) Do not pump or drain any water containing excessive suspended materials or harmful substances into waterways, sewers or other drainage systems. Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with the governing authority's limitations and requirements.

(i) The Contractor shall be responsible for all damages within or outside the Site directly resultant from the Contractor's actions, omissions or neglect which may be caused by or which may result from water backing up, flowing through, overflowing or excessive surcharge of drainage systems.

(j) The Contractor shall organize and bear all costs related to the effective dewatering of the excavations and all other pumping and drainage necessary for the proper execution of the Work, including keeping the pipes, structures, shafts, excavations and trenches free of undesirable accumulations of groundwater, seepage, surface water, melt water or rain water.

(k) All dewatering equipment and discharge hoses shall be protected from freezing and shall remain fully operational in freezing weather.

(l) Dispose of all water drained or pumped as above by discharging it into sewers, drainage ditches or natural water courses as reviewed by the Contract Administrator, and in compliance with all local, Municipal, Provincial and Federal environmental regulations, ordinances, bylaws, etc., and provide documentation indicating that authority has been granted to discharge effluent water into any drainage ditch, brook, creek or river. The Contractor shall develop and implement at their own cost any filtration, settlement or other acceptable treatment methods required prior to disposal.

(m) Keep all drainage channels, gutters, swales, ditches, sewers, culverts and disposal areas free of silt, sand, debris and gravel and remove such deposits as required.

E27.5.4 Initial Ground Support Systems - General

(a) Construct initial ground support systems to line, grade, dimensions, and tolerances that allow permanent structures and pipes to be placed as shown on the Drawings and in accordance with specified tolerances.

(b) Dewatering is not permitted. Where water table is high and permeable soils are encountered the contractor shall employ sealed shaft construction methods to avoid dewatering.

(c) Sealed shaft construction methods include secant piles, slurry wall, precast concrete caisson, cast in place concrete caisson, sheet piling or other methods capable of being constructed in the conditions identified in the GBR and meeting the performance requirements of the project.

(d) As the excavation progresses, perform periodic verification of shaft vertical alignment.

(e) Develop and maintain firm and uniform bearing of the support system against the ground by advancing the support system in advance of excavation, or by timely placement of internal supporting members, or by expanding the support system tightly against the ground, or by timely backfill grouting between a non-expanding support system and the ground.

(f) As the excavation progresses, perform periodic inspections for indications of loosening or instable ground; loss of ground through the support system; cracking and subsidence of ground near the excavation; or excessive deformation, overstress, or weakening of the initial support system.

(g) Maintain the initial ground support system in fully functional condition for the duration of its use. Promptly reset, repair, or replace support system elements that settle, become misaligned, were improperly installed, or become damaged.

(h) Utilize excavation methods which prevent basal heave or soil piping methods leading to instability of the shaft base.

E27.5.5 Initial Ground Support Systems in Soil

(a) Adopt adequate embedment depths to prevent basal heave or soil piping leading to instability of the shaft base, and adopt tremie concreting methods for construction of the shaft base where appropriate.

(b) Where precast or cast in place systems are used, utilize bentonite or other supporting mud to assist shaft sinking and minimize the movement of the ground surrounding the shaft.

(c) Coordinate the installation of initial support systems with excavation to prevent heaving or raveling of exposed soils.

E27.5.6 Backfill Grouting of Precast Concrete or Cast-In-Place Concrete Caisson Linings

(a) On completion of shaft sinking grout behind the lining to displace annular bentonite, minimize ground movement into the annular space, and migration of fluids through the annular space.

(b) Inject grout in continuous progression of grout holes along the perimeter of the shaft, commencing from the bottom of the shaft and working upwards.

(c) Pump grout until material discharging from next hole in sequence is similar in consistency to that at the point of injection. Exercise care to completely fill voids around any obstruction to the natural flow of grout.

(d) Grouting pressure shall be established by the Contractor, but shall not exceed safe limits established by the Contractor in advance. Control grouting pressure to avoid distorting the shoring.

(e) Equip the grout plant with reliable pressure gauges at the point of injection and at the pump, to provide accurate pressure readings on a continuous basis.

(f) After completing the grouting of a hole, hold the grout by means of the stop valve until the grout has set to the extent that it will be retained in the hole.

E27.5.7 Removal of Initial Ground Support Systems

(a) Wall support shall be left in place with the exception of the top 1.5 m below final ground elevation, which shall be removed, unless otherwise accepted by the Contract Administrator. Bracing members shall be removed in a sequence that prevents any movement of the wall support.

(b) Sheeting shall be removed, where permitted, as the excavation is backfilled, and in a manner to maintain stability and strength of soils, and to avoid disturbing adjacent utilities and structures. Voids left on removal of sheeting shall be backfilled to prevent subsidence.

(c) Support systems that extend below the bottom of the excavation, such as sheeting, shall not be removed.

(d) Support systems that cannot be removed without causing damage to existing structures, utilities, or the Work, in the sole opinion of Contractor, shall be left in place at no additional cost to the project.

(e) Shoring systems not being utilized as the final chamber wall shall be removed to the height of the final chamber roof elevation.

(f) Contractor to provide as-built of locations of shoring remaining in place.

(g) Repair any settlement or damage to the Work or adjacent property resulting from removal of initial ground support systems.

E27.5.8 Soil Excavation

(a) Adopt a shaft support system that maintains continuous ground support during excavation.

(b) Excavate in a manner to minimize loss of soil into the excavation, to minimize soil movement outside the excavation, to maintain stability of the excavation, and to preserve the existing strength of soils surrounding the excavation.

(c) Methods of ground stabilization and groundwater control employed at shaft entry and exit points, such as ground freezing or jet grouting, shall be compatible with methods of tunnel excavation.

E27.5.9 Shaft Bottom Stabilization

(a) Design and install a concrete base connecting to the wall support system, to prevent ground heave, loss of fines and water ingress.

(b) Use of foundation stabilization material shall conform to CW2030.

(c) Where ground and hydrostatic conditions require, utilize tremie concreting techniques for placement of shaft bases.

(d) Stabilize the foundations of structures not in the shaft as necessary to prevent damage from the proposed shaft installation.

(e) Where the existing material in the bottom of the excavation is unsuitable for supporting the structure, over-excavate and replace with suitable granular material compacted to 95% SPDD or cementitious material as shown on the Drawings. Any open graded material shall be wrapped in a non-woven geotextile fabric to prevent the transfer of fines.

(f) Use of foundation stabilization material made necessary by Contractor's failure to maintain bottom stability due to inappropriate means of ground support or groundwater control shall be the responsibility of the Contractor.

E27.5.10 Rock Excavation

(a) Excavate rock in a manner to maintain stability of the rock, and to prevent loosening or slabbing of the rock.

(b) Minimize overbreak in excavating rock. The cost of handling overbreak and backfilling the resulting void will be considered incidental to the Work, and no additional payment will be made.

(c) Use of explosives in shaft excavation to excavate rock is not permitted.

E27.5.11 Control of Vibrations

(a) Control of vibrations to prevent damage to the work or to adjacent property caused by vibrations from driving piles shall conform to the requirements of E19.

E27.5.12 Backfill of Shafts

(a) Remove all form materials and trash from the excavation before placing any backfill. Remove loose, sloughing, or caving soil from bottoms and sidewalls of excavation.

(b) Backfill around cast-in-place concrete only after concrete has attained 2/3 of the specified 28-day compressive strength. Review backfilling requirements of permanent construction with respect to attained concrete strength prior to backfilling.

(c) Raise backfill uniformly to prevent unbalanced lateral loading that could push the shaft structure out of vertical alignment.

(d) Limit lift heights to prevent hydrostatic loading that would overstress the shaft structure.

E27.5.13 Shaft Security

(a) Extend shaft lining around the full perimeter of shaft to a minimum height of 1 metre above grade. The extended shaft lining shall provide a level of security equivalent to one full ring of liner plate backed by one steel support rib at mid-plate height.

(b) Secure shaft excavations deeper than 3 metres during all periods when shaft site is unoccupied by Contractor or security personnel, including routine absences such as lunch breaks, overnight, and weekends.

(c) Security measures shall be designed to deter vandalism, and to prevent unauthorized or accidental entry of persons, animals, or objects into the shaft. Minimum security measures shall consist of items (i) or (ii) below. Item (iii) is required at all locations:

(i) temporary shaft cover consisting of a rigid steel frame covered with steel mesh, expanded metal, or equal, with sufficient structural capacity to support persons standing on the cover;

(ii) temporary shaft cover consisting of steel or nylon netting, with sufficient structural capacity to support persons standing on the netting; fully secured to the extended shaft lining; and

(iii) chain link security fence conforming to these Specifications, installed on the shaft work site perimeter; closed and locked whenever the site is unattended by Contractor's personnel.

(d) Excavations which are exposed to public vehicular traffic, including run-off-the-road traffic, shall be barricaded along the exposed side with portable concrete "Jersey barriers" designed and positioned to deflect errant vehicles.

E27.5.14 Line and Grade

(a) Line and Grade during the Launching and Receiving Operations: line shall be maintained within ± 120mm and grade shall be maintained within ± 60mm at any point.

E27.6 Measurement and Payment

E27.6.1 Construction of Microtunnelling Shafts

(a) Construction of Microtunnelling shafts will be measured on a Lump Sum basis for each location as specified in Form B: Prices and at the respective Contract Unit Price for “Construction of Microtunnelling Shafts”. The Lump Sum to be paid for will be for the complete construction of the shaft at each.

(b) Payment for construction of microtunnelling shafts will include all materials, labour and performing all operations necessary to complete the Works as specified and as indicated on the Drawings including all items incidentals to the Works.

E28. MICROTUNNELLING

E28.1 Description

E28.1.1 This specification describes the requirements for constructing the siphon pipeline using microtunnelling methods as defined herein.

E28.2 General

E28.2.1 Furnish all labor, equipment, materials and incidentals necessary to install the sewer pipeline in accordance with the requirements of this specification. Be responsible for the special requirements, as defined herein.

E28.2.2 Provide a Microtunnel Boring Machine (MTBM) that meets the requirements of this specification.

E28.2.3 Construct the microtunnelling shafts in accordance with E27.

E28.2.4 Dewatering or drawing down of the groundwater table is not permitted. Construction water removal is permitted at the launching shafts during microtunnelling operations to prevent interfering with the pipe lubrication process and/or slurry operations. The launching shafts shall be sufficiently watertight to limit the loss of operating fluids.

E28.2.5 If inflow of ground and/or groundwater exceeds the specified limit or if the machine deviates from the alignment more than the specified limit for either horizontal alignment or vertical elevation during the launching and/or receiving process, then ground improvement, as defined herein, shall be implemented at launching and receiving shafts for each remaining drive.

E28.3 Definitions

(a) Refer to ASCE 36, see also E30.

E28.4 Submittals

E28.4.1 Submit the following in accordance with E4 a minimum of ten (10) Business Days prior to commencement of microtunnelling work:

(a) Construction Method and Sequence of Operations:

(i) Provide a description of the proposed method of construction and the sequence of operations to be performed during construction. A general description and schedule of the tunneling procedure, including but not limited to, construction of the shafts, set-up of tunneling equipment, muck disposal, methods of protection and maintenance of project site, and ground and groundwater control methods.

(b) Site Layout:

(i) Typical layout of launching and receiving shaft work sites showing equipment locations, materials storage, muck storage, site offices and facilities, worksite access and egress.

(ii) Source of potable water to be used at each location.

(c) MTBM Equipment

(i) Provide manufacturer information, including preprinted machine specifications, installed options, operating instructions, and manuals. Furnish recommended spare parts lists and maintenance checklists. Include performance specifications for the MTBM, back-up plant, and all ancillary equipment. Furnish inventory list of spare parts received and stored on site. Also furnish manufacturer's literature indicating MTBM boulder crushing capability.

(ii) Additionally for a used MTBM, prior to starting this project, provide a certification in writing that the MTBM has been certified fit for use based on the anticipated project conditions.

(iii) Detailed shop drawings of the MTBM, including configuration of cutter wheel along with details of the tools and hard facing.

(iv) MTBM grade and alignment control system details to include type of guidance system and/or enhanced guidance systems with complete details on equipment capabilities and limitation.

(v) Groundwater control provisions for the MTBM and seals to prevent inflow of water into the MTBM, machine cans, and pipe string.

(vi) Electrical system, lighting system, and on-site power generation. Also provide details of power supplied by utility provider.

(vii) Submit alignment installations checks as required in this specification.

(viii) Details of overcut to include size of overcut, which is not to exceed 25 millimetres or the pipe manufacturer overcut recommendation. The submitted overcut shall be reviewed and accepted by the Contract Administrator prior to implementation.

(ix) Details for access to cutting wheel for tool replacement, including need for hyperbaric chambers or other means of isolating face for retooling from external groundwater.

(d) Launch Procedures:

(i) Complete launch procedure. Describe any modifications to the designed shoring for launching the MTBM and when these modifications are to be in place. Describe any the ground stabilization adjacent to the shoring and when the stabilization methods are to be in place.

(ii) Provide details of the entrance seal.

(iii) Complete receiving procedure for the MTBM. Describe any modifications to the designed shoring for receiving the MTBM and when these modifications are to be in place. Describe any ground stabilization adjacent to the shoring and when the stabilization methods are to be in place.

(iv) Provide details of exit seal and the methods for guiding the MTBM into the seal.

(e) For Slurry-MTBM, submit details of slurry system and soil separation methods including slurry formulations by soil type, and calculations of the system capacity to handle flows at all proposed distances and changes of elevations to and from the face of the MTBM and to and from the slurry separation plant.

(i) Submit Material Safety Data Sheet (MSDS) for slurry additives.

(ii) Use of NSF/ANSI Standard 60 Certified materials only, or approved equal in accordance with B7.

(iii) Calculations and operating information to be controlled with the intent of preventing inadvertent returns and balancing face pressure.

(iv) Sample slurry log sheet including time, date, sample, shaft location, pipe number, slurry additives, quantity added, soil type, viscosity, specific gravity, water added, and operating pressure.

(v) Account for ground characteristics to include equipment wear, high permeability and slurry loss, and fine grain content with difficult separation.

(vi) Indicate limits of target control of sediment content within the slurry.

(f) For EPB-MTBM, submit details of complete muck transport system from tunnel face to muck storage locations. Provide detailed procedures for determining conditioning agents by soil type to be used to assist in maintaining earth pressure balancing and relief for the anticipated soil conditions and test measurements to ensure acceptable performance of conditioning agents. Details of proposed conditioning agent formulations by soil type, and calculations of the system capacity to handle flows at all proposed distances and changes of elevations to and from the MTBM.

(i) Submit Material Safety Data Sheet (MSDS) for conditioning agents.

(ii) Use NSF/ANSI Standard 60 Certified materials only, or approved equal in accordance with B7.

(iii) Sample conditioning agent log sheet including time, date, sampler, shaft location, pipe number, conditioning agents, quantity added, soil type, viscosity, specific gravity, water added, and operating pressure.

(g) Description of automatic lubrication mix equipment and procedures for lubricating the pipe during the jacking operations to include the estimated volume for the anticipated site conditions. Account for ground characteristic to include any swelling clay and highly permeable ground. Provide automatic pipe lubrication with computerized output system details. Take into account roll of machine, filling of overcut, and support for the ground. Also consider the effect of higher jacking loads due to work stoppages and interruptions.

(i) Submit Material Safety Data Sheet (MSDS) for lubricant additives.

(ii) Use NSF/ANSI Standard 60 Certified materials only, or approved equal in accordance with B7.

(iii) Details that demonstrate that the lubrication delivery system shall have sufficient pressure and volume to perform as intended. Calculations shall demonstrate adequate volume and pressure of the lubricant to completely fill the annular space with considerations for overcoming ground water pressures and any fluid loss in permeable soil.

(iv) Sample lubrication log sheet including time, date, sample, shaft location, pipe number, slurry additives type, quantity added, soil type, viscosity, specific gravity, water added, and system operating pressures and volumes.

(v) Furnish computerized output parameters in accordance with submitted microtunnelling operations log. Computerized output shall be selected by Contract Administrator from various formats produced by the software used with the automatic lubrication plant. Computerized output shall include but not be limited to time, date, injected volume, and injection pressure at each point of injection along the pipe string.

(h) Jacking system details, IJS and their proposed spacing, method of operation, thrust capacity, and sleeve details, plus method of control to prevent exceeding the maximum allowable jacking force, as defined herein, on the jacking pipes.

(i) Theoretical jacking force calculations and pipe material calculations shall be prepared and submitted in accordance with Specifications E30 and E30.

(ii) If the jacking force calculations are based upon the use of a lubricant and/or IJS, then the lubricant and/or IJS shall be used in accordance with the submitted calculations.

(iii) Contractor shall furnish product pipe submittals in accordance with appropriate pipe specifications.

(iv) thrust wall at each launching shaft location.

(v) Submit IJS design and details including number of stations, location, and jacking force.

(i) Pipe lay schedule for each drive noting the following requirements:

(i) Drawings of all microtunnelling pipes for straight and curved alignments including all type of pipes (regular and interjacking pipe) and pipe lay schedule for each tunnel drive including interjacking frames locations.

(j) Proposed contingency plan for potential issues regarding tunneling operations shall be provided for the following scenarios:

(i) The MTBM encounters an unmovable obstruction manmade and/or natural.

(ii) The jacking pressures start to increase rapidly and reasonable concern exists for completing the pipe jacking installation process to the receiving shaft. Include discussion on pipe damage, lubrication aspects, implementation of IJS, and, in the extreme case, the use of rescue pits.

(iii) Pipe suffers severe damage or exceeds 90 percent of its maximum allowable jacking force and the structural pipe monitoring system is required. Describe process for implementing structural pipe monitoring systems on each subsequent drive. Provide the schedule for the monitoring system to be on-site, installed, tested, and in proper working order.

(k) Submit injury and illness reports that are required by local, provincial, and federal regulations. Submittal is not for review and only to demonstrate compliance with applicable laws.

(l) Survey plans including, but not limited to, the following:

(i) Settlement surveying and monitoring plan.

(ii) Building and structures assessment plan.

(iii) Instrument locations.

(iv) Initial survey.

(v) Final survey.

(vi) Verification of line and grade for MTBM operations.

(vii) As-built survey for each installed length of the sewer pipe within 24 hours of the completion of each drive or reach.

E28.4.2 Submit Microtunnelling operations log(s) in accordance with E4:

(a) Provide a sample of logging reports and daily reports prior to beginning microtunnelling.

(b) Transcribe to paper and submit to Contract Administrator at the end of each shift a jacking operations log completed by the MTBM operator complete with the date and names of MTBM operator and project superintendent. Both MTBM operator and Project superintendent shall initial and date. The jacking operations log shall include the following:

(i) Provide starting and finish times for each crew shift.

(ii) Observations of settlement or heaving.

(iii) Sampling interval shall produce at least three measurements per pipe and shall not exceed a 15 minute time duration to include:

- Time of measurement.
- Position of the MTBM in relation to design line and grade. Include the distance of the MTBM from the launching shaft.
- Number of each pipe installed and length of pipe.
- Position of IJS in the installed pipeline. Include maximum jacking forces exerted on the pipe from each of the IJS.
- Maximum jacking forces exerted on the pipe from the main jacking system.

- Position of steering jacks.
- Inclination of MTBM and torque of cutter wheel.
- Hydraulic pressures.
- Volume of pipe lubricant used, viscosity, pumping pressure, and name of the operator of the lubrication plant. Provide lubrication details.
- Provide output from the automatic lubrication plant in approved format.
- For Slurry-MTBM, face pressure and volumetric flow rate of slurry.

(c) Automated data recording system for microtunnelling:

(i) Submit a sample of all information available for recording, variations in sampling frequency, and the formats in which these data can be recorded and presented.

(ii) The Contract Administrator will then select the information, sampling frequency, and format of the data based on these samples.

(iii) The sampling interval selected by the Contract Administrator will produce at least three measurements per pipe, and it will not exceed 1 minute time durations.

(iv) At a minimum the automated data recording system shall record the time; date; distance; and hydraulic pressures for the main jacking system and the IJS; torque at the cutter wheel; pressure at the face; extension of each of the steering cylinders; machine orientation to include pitch, roll, and yaw; deviations from alignment line and grade; and the rate of pipe advancement.

(v) This information shall be submitted on a daily basis using an electronic thumb drive or other approved device.

(d) For Slurry-MTBM, results from sediment content tests to monitor plant efficiency.

E28.4.3 Contractor's Qualifications: Contractor shall submit the qualifications of personnel in accordance with E4 and E28.7 using the sample form included in Appendix C.

E28.5 Materials

E28.5.1 The following pipe material shall be considered acceptable for use with microtunnelling on this project:

(a) Reinforced concrete pipe supplied and installed in accordance with E30.

E28.5.2 Joint Cushion

(a) The driving ends of reinforced concrete and any intermediate joints shall be protected against damage using a suitable packer cushion.

(b) Joint cushions shall be designed to accommodate anticipated jacking pressures while distributing load around the circumference of the joint.

(c) Joint cushions at minimum should be constructed from plywood, medium density fibreboard, or similar material with a minimum thickness of 9.5 mm.

(d) Hydraulic packers should be considered if joint deflections exceed ability of joint cushions to distribute load.

E28.5.3 Potable Water

(a) Obtain from a potable water source in accordance with E10.

(b) Use soda ash, or approved equal in accordance with B7, with the submittal of an MSDS, to adjust the pH of the water as required in mix designs.

E28.5.4 Contact Grout

(a) As per requirements contained in E31.

E28.6 Safety Requirements:

(a) Provide dedicated site safety representative while performing work.

(b) Provide readily available access to Health and Safety Plan (HASP) for all personnel on-site. Copy of HASP shall be in the control cabin at each launching shaft location while performing work.

E28.7 Experience Requirements

(a) MTBM Operator: Experience requirements include the construction and completion of a minimum of three pipeline projects installed by microtunnelling methods, each with a drive length of at least 200 metres for installed pipe between 900 mm and 2100 mm inside diameter. The reference projects shall have been completed in the previous 5 years prior to the bid date. The MTBM operator shall also have:

(i) Operated an MTBM similar to the one proposed.

(ii) Utilized the same type of pipe material as that used for the jacking pipe on this project.

(iii) Successfully completed a project in similar ground conditions to those contained in the GBR.

(iv) Operator for drives using a structural pipe monitoring system, if required, shall demonstrate experience with the system, else documentation of manufacturer recommended training will be required at no additional cost to City.

(b) Contractor's Engineer: Experience requirements include Professional Engineer licensed by the Province of Manitoba having an experience record demonstrating qualifications for designs and calculations to be performed.

(c) Surveyor for the Contractor: Experience requirements include professional surveyor and an experience record demonstrating underground surveying experience including the transfer of points and line from the surface to below surface.

(d) Machine rebuilder for any used MTBM equipment: Experience requirements include written letter from MTBM manufacturer certifying the machine rebuilder is authorized to refurbish and recondition the MTBM.

(e) Guidance/Enhanced guidance systems: The system manufacturer for any guidance system and/or enhanced guidance system shall have been producing similar commercially available systems for not less than the past five years. The system shall be specifically intended for use with pipe jacking applications. Experience record shall include the most recent twenty tunneling projects where the systems were used successfully.

(f) Structural pipe monitoring systems: The system manufacturer for any structural pipe monitoring systems shall have been producing similar systems for not less than the past five years. The system shall be specifically intended for commercial use with pipe jacking applications. Experience record shall include the most recent twenty tunneling projects where the systems were used successfully.

E28.8 Microtunnelling Design

E28.8.1 Design Requirements

(a) Every design submitted as part of this specification shall be signed, sealed, and dated by the Contractor's Engineer registered in the Province of Manitoba.

(b) Use recognized standards to the extent possible.

(c) Provide comments, assumptions, symbols, units, sketches, and input parameters as necessary to convey the design intent.

E28.8.2 Jacking Thrust

(a) Determine size of thrust wall at each launching shaft location. Demonstrate that ground has sufficient reaction without excess deformation using not less than 300% of the maximum anticipated jacking loads. Fully describe any mitigation measures to be implemented, as necessary, such as IJS and/or isolation of thrust wall.

(b) Intermediate Jacking Stations (IJS) shall be required when:

(i) The maximum anticipated jacking force exceeds 70% of the maximum allowable jacking force exerted on the pipe;

(ii) The capacity of main jacks does not exceed the maximum anticipated jacking force by at least 50%; or

(iii) To prevent movement of thrust wall or misalignment of jacking frame.

(c) IJS shall be capable of withstanding the jacking forces with a minimum factor of safety of 2.0.

E28.8.3 Existing Project Conditions

(a) The Contractor is responsible for the ground, groundwater, and gas conditions defined in the GBR.

(b) Comply with applicable codes, standards, and regulations.

(c) Assess existing conditions, including property rights of adjacent properties whether private or public, for the possible effects of proposed temporary works and construction methods.

(d) Reports: GDR and GBR.

E28.9 Quality Control

E28.9.1 Defective materials: Any material found to be defective shall be immediately marked “DEFECTIVE – NOT FOR USE”. This marking shall be clear from any point of view and shall be permanent. The defective material shall then be transported off-site and properly disposed in a time period not to exceed 24 hours.

E28.9.2 Provide access to Contract Administrator at all time during construction operations to perform inspections and to observe quality.

E28.9.3 The Contract Administrator shall be allowed access to manually record the operating parameters during the microtunnelling operations such as pitch, roll, yaw, guidance system information, valve positions, thrust force, cutter wheel torque, rate of advance, and installed length of pipe. Access to this information shall be provided either by admitting the Contract Administrator into the control cabin to record the data or else by setting up a remote electronic display monitor that contains the same information as that displayed on the operator control console in real time. This remote monitor shall be located in a suitable shelter in the vicinity of the launching shaft.

E28.9.4 Provide the Contract Administrator with access to manually record the pressure gauge, volumetric gauge, and position of the shut-off valve for the lubrication system during the microtunnelling operations.

E28.9.5 The Contractor shall furnish six (6) lubricant samples per drive from the mixing pump, at times selected by the Contract Administrator. Samples shall be collected by the Contractor in suitable clean, unmarked, clear plastic, pint-sized containers with removable lids that do not leak. These samples shall be marked and then stored for the duration of the drive plus an additional month after hole through of the receiving shaft; at any time during this period, these samples shall be immediately furnished to the Contract Administrator upon request. Markings on the containers shall include date, time, drive number, and pipe number.

E28.9.6 Survey the tunnel not less than once daily.

E28.10 Equipment

E28.10.1 MTBM: Provide an MTBM with the following features:

(a) General: The microtunnelling system selected shall be specifically designed for excavating, transporting, and separating the materials encountered along the sewer alignment as defined in the GBR. This equipment shall be capable of satisfactorily installing the jacking pipe as contained herein.

(b) Requirements for the MTBM include:

(i) Pressurized face support. The MTBM shall maintain the tunnel face under wet, dry, and adverse soil conditions. The MTBM shall provide pressurized support of the excavated face at all times including temporary shutdowns during operations. Carefully controlled face pressure for supporting the excavation face as well as to prevent inflows of ground and/or groundwater. The system shall maintain control during both excavation and shutdown periods.

(ii) The MTBM shall be steerable in both the vertical and horizontal directions to install the jacking pipe on the line and grade shown on the Drawings, within the specified tolerances for the anticipated ground at tunnel level as contained in the GBR.

(iii) Seal mechanism between the MTBM and the leading pipe.

(iv) Water damage protection for electric and hydraulic motors and operating controls.

(v) Bi-directional drive on the cutter wheel to control roll. Other measures such as adjustable fins and/or other means shall be used, as necessary.

(vi) High pressure water jet ports inside the excavation chamber for cleaning sticky materials.

(vii) Back loading cutting tools replacement.

(viii) Synchronized control of the excavated material volume with the advance rate of the machine to limit ground loss and/or heave during operation.

(ix) The overcut of the shield shall not exceed the value submitted with overcut details.

(x) Crushing capability of boulders equal to at least one third the machine diameter.

(xi) Tunnel face access hatch behind the cutterhead to permit man access for obstruction removal and tool maintenance.

(c) Accepted Manufacturers:

(i) Akkerman;

(ii) Herrenknecht; or,

(iii) approved equal in accordance with B7.

E28.10.2 Pipe Launching Equipment: Provide a pipe jacking system with the following features:

(a) Main hydraulic cylinders mounted in a jacking frame located in the launching shaft used to push the MTBM and pipe through the ground. Jacking frame shall be sufficiently anchored/braced to prevent any misalignment.

(b) Jacking system that successively pushes the MTBM along with a string of connected pipes towards a receiving shaft.

(c) Sufficient jacking capacity to push the MTBM and the pipe string between the shaft locations as identified on the Drawings.

(d) Hydraulic cylinder extension rates shall be synchronized with the excavation rate of the MTBM and be compatible with the ground conditions.

(e) Uniform distribution of jacking forces on the end of the pipe by use of thrust ring and packers.

(f) Monitored hydraulic pressure and cylinder extension. The system shall have automatic shut off to prevent overstressing of the pipe being jacked.

E28.10.3 Optional Remote Control System: Provide a remote control system, at the Contractor's discretion, to help maintain higher safety levels. The recommended system has the following features:

(a) Allows for operation of the system without the need for personnel to enter the tunnel. Has a display available to the operator, showing the position of the shield in relation to a design reference together with other information such as pitch, roll, yaw, complete

guidance system, valve positions, thrust force, cutter wheel torque, rate of advance, and installed length.

(b) Integrates the system of excavation and removal of muck with the simultaneous installation of pipe. As each pipe section is jacked forward, the control system synchronizes all of the operational functions of the system.

E28.10.4 Active Direction Control: Guidance systems that do not perform adequately shall be immediately replaced.

(a) Provide an active direction control system that is fully compatible with the MTBM; this system shall have the following features:

(i) Controls line and grade by a guidance system.

(ii) Equipped with a high intensity laser (maximum legal limit). The laser shall be securely mounted and protected from disturbance by personnel working within the launching shaft. When laser capacity is exceeded enhanced guidance systems shall be incorporated.

(iii) Capable of maintaining line and grade to the tolerances specified.

(iv) Provides active steering information that is monitored and transmitted to the operating console in real time. At a minimum, this information shall include location of the laser beam on the target and location of the cutter-head.

(v) Provides positioning and operation information to the operator on the control console.

(vi) Provides a reference laser, or other submitted device, that indicates visually in the launching shaft that the directional control laser has not been accidentally moved.

(vii) Provide ventilation to maintain temperature control within tunnel to minimize laser projection disturbance onto the target.

(b) Enhanced Guidance System:

(i) Furnish and operate an acceptable enhanced guidance system whenever the drive length exceeds the manufacturer rated capability of the laser guidance equipment or whenever the guidance system becomes unstable and cannot be seen clearly on the steering target, whichever condition is the more restrictive.

(ii) Any enhanced guidance system used shall be on-site, installed, tested, and in working order prior to implementation as verified in writing by authorized representative for systems manufacturer.

(iii) For enhanced guidance systems, provide complete manufacturer recommended system. Perform manual surveys in accordance with written recommendations of supplier not to exceed intervals of 30 m.

E28.10.5 Slurry separation equipment for use with Slurry-MTBM: Provide a slurry separation system that is capable of the following:

(a) Provide adequate separation of the muck from the slurry to maintain microtunnel operation with no suspension of activities due to issues with separation of fine contents such that the slurry has sediment content below the limits set by the submitted Work Plan and can be returned to the cutting face for reuse. Test sediment content daily. Use a mechanical separation plant, including scalping screens, shaker screens, de-sanding and de-silting cones, and centrifuge as deemed necessary. Contain the muck at the site prior to disposal as submitted in the Work Plan.

(b) Use the type of separation process suited to the size of the tunnel being constructed, the soil type being excavated, and the workspace available at each launching shaft location for operating the plant.

(c) Carefully monitor the composition of the slurry to maintain the slurry weight, gel strength, and viscosity limits defined by the submitted Work Plan.

E28.10.6 Muck transport equipment for use with EPB-MTBM: Provide a muck transport system that is capable of the following:

(a) Transporting the muck throughout the tunnel length from the EPB-MTBM up the shaft to the muck storage site.

(b) The muck transport equipment shall accommodate the guidance system and not interfere with its operation.

E28.10.7 Automatic Lubrication System: Provide computerized control of plant with recorded output. Regulate using pressure gauge, volumetric gauge, and shut-off valve on the pump or at the point of injection capable of preventing over pressurization and subsequent damage to jacked pipe, heave, or inadvertent returns.

E28.10.8 Safety Equipment: Provide all appropriate safety equipment as necessary and as required by all applicable Laws and Regulations.

E28.10.9 Structural Pipe Monitoring System: Any structural pipe monitoring system used shall be on-site, installed, tested, and in working order prior to implementation as verified in writing by authorized representative for systems manufacturer.

E28.11 Construction

E28.11.1 General

(a) Limit ground movements and vibrations to those specified in E35.

(b) The Contractor is responsible for any additional requirements to include impacts to cost and schedule for operating in “hazardous gas” conditions to include monitoring, ventilating, operating in an explosion proof environment, if encountered.

(c) Use equipment that is in proper working order without excessive equipment wear and/or malfunction history as defined herein.

(d) Confine the microtunnelling operations to the limits as shown on the Contract Drawings. Minimize impacts to surroundings.

(e) Employ measures to reduce noise and vibrations to comply with applicable regulations and noise By-Laws.

(f) Restore the site conditions in accordance with the Contract Documents.

E28.11.2 Preconstruction Meeting

(a) The Contractor shall prepare and provide a presentation for the Pre-Construction meeting or for a mutually agreed upon separate meeting to review and discuss the following items with the Contract Administrator at a minimum of fifteen (15) Business Days prior to commencement of the microtunnelling work. Provide handouts to go along with Contractor presentation.

(i) Scope of work to be performed.

(ii) Construction methods and constraints overview.

(iii) MTBM operating parameters, equipment capabilities, condition assessment of equipment, and required support equipment.

(iv) GBR to include ground, groundwater, and hazardous gas conditions.

(v) Special measures for long drives.

(vi) Surveying equipment, methods, and techniques.

(vii) Guidance system, steering, mixed ground conditions, recovery to line and grade, field verification, and tolerances.

(viii) Settlement, mitigation measures, mixed ground conditions, and the potential for damage to structures and facilities.

(ix) Pipe damage, packer cushions, lubrication, steering, jacking forces, and intermediate jacking stations.

(x) Instrumentation program to include installation, monitoring, and reporting.

(xi) Impacts to structures, buildings, and properties.

(xii) Launch shaft sites as well as machine launching process to include layout of site, parking, and security measures.

(xiii) Receiving shaft sites as well as machine receiving process.

(xiv) Rescue pits, machine failures, and man-made and natural obstructions.

(xv) Pipe materials, manufacturer, shipping, storage, handing, and installation.

(xvi) Job site safety procedures.

(xvii) Quality Control procedures and Quality Assurance measures.

(xviii) Acceptance testing.

(xix) Reporting requirements.

(xx) Submittals drive schedule, and production.

(xxi) Other issues as may be raised by either party.

(b) The Contractor shall make available to attend this meeting the project manager, project superintendent, MTBM operator, Contractor's Engineer, surveyor for the Contractor, instrumentation specialist, and the designated site safety representative. The representative from the pipe manufacturer and the representative for the MTBM supplier or the refurbisher of this machine shall also be present unless a written statement is received by the Contract Administrator at least three (3) Business Days in advance stating that these otherwise required participants are not available to attend this meeting.

(c) Schedule this meeting at least fifteen (15) Business Days in advance at mutually agreed date. The Contractor shall provide adequate and detailed coverage of the topics as well as answer questions to the satisfaction of the Contract Administrator; the Contractor shall allocate not less than 4 hours for this meeting.

E28.11.3 Launching and Receiving

(a) Shafts: Construct the launching and receiving shafts for microtunnelling in accordance with E27 and as specified on the Drawings.

(b) Process: If the inflow of ground and/or groundwater exceeds the specified limit during the launching or receiving process or if the machine deviates from the alignment more than the specified limit for horizontal alignment and/or for vertical elevation during the launching and/or receiving process, do not begin a new drive until ground improvement, as defined herein, has been implemented at the break-out and break-in locations at each of the launching and receiving shafts for each of the subsequent drives.

E28.11.4 Work Area Preparation and Maintenance

(a) Contractor shall be responsible for the following:

(i) Means and methods: Select the means and methods in accordance with this specification.

(ii) Safety: Provide and maintain safety to include but not limited to construction personnel, the public, and adjacent property, whether public or private.

(iii) Clean working conditions: Remove muck, debris, equipment, and other material that is not required for operations. Pipe shall not be stored on any city streets unless given written permission by the Contract Administrator. Streets shall be kept clean at all times. Complaints shall be addressed to maintain appropriate community relations especially with respect to noise, dust, debris, parking, mowing, snow removal, and lighting to the fullest extent reasonable.

(iv) Organization: The construction equipment shall be organized to enable efficient operation at all times.

(v) Provide suitable oil and gas containment basins made of plastic lining and sand bags to ensure no loss of oil to drains, water courses, or ground contamination.

(vi) All equipment shall be maintained and kept in proper working order. All oil, hydraulic, or fuel leaks shall be repaired immediately. Any leak shall be cleaned up immediately and disposed of properly.

(vii) All lubricant and slurry spills shall be immediately contained, cleaned up, and disposed of properly.

(viii) All work to be completed in accordance with E5.

E28.11.5 Installation

(a) The MTBM shall not be launched on any drive until the appropriate receiving shaft is completed for retrieval of the tunneling equipment.

(b) Prior to commencing any drive, The Contractor shall demonstrate that:

(i) The jacking loads can be safely maintained on the pipe using actual drive data.

(ii) Intermediate jacking stations (IJS) have performed successfully.

(iii) The guidance system(s) is functioning properly and meets the requirements, as specified herein, for the longer drive length.

(iv) The automatic lubrication system has performed successfully.

(v) Any contingency measures that were implemented by the Contractor are working effectively.

(c) Do not damage the product pipes during the installation process.

(d) Establishing the Alignment: Contractor shall be responsible for adherence to the following requirements and conditions:

(i) Qualified surveyor for the Contractor shall perform all of the surveying and check baseline and benchmarks prior to any tunneling work and report any errors or discrepancies to the Contract Administrator.

(ii) Use the baseline and benchmarks shown on the Drawings to furnish and maintain reference control lines and grades for the sewer pipe construction. Use these lines and grades to establish the exact location of the pipeline excavation and structures.

(iii) Establishing and maintaining the accuracy of control work to included alignment and grade of the sewer pipe.

(iv) Establishing control points sufficiently far from the tunnel operation so as not to be affected by ground movement.

(v) Check the primary control for the microtunnelling system against an above ground undisturbed reference at least once each week or not greater than 75 m intervals of pipeline being constructed.

(vi) Perform survey traverse as per reviewed submittals when implementing enhanced guidance systems.

(e) Maintaining the Alignment: Contractor shall adhere to the following requirements and conditions:

(i) Pipe installation shall not vary by more than the allowable alignment deviations as specified herein.

(ii) Record the exact position of the MTBM at 2.5m intervals or a minimum of once per pipe segment, whichever is more often, to ensure the alignment is within the specified tolerances. The tunnel guidance system may be used; however, select times to measure and record this information after the air temperatures have stabilized throughout the pipe to ensure accurate readings.

(iii) Immediately correct any misalignment. When the excavation is off line or grade, return to the design line and/or grade over the remaining portion of the drive and at a rate of not more than that specified.

(iv) If alignment deviations are exceeded, Contractor shall pay all costs for correction (redesign, reconstruction, and re-inspection). If redesign is required, Contractor shall obtain the services of a Professional Engineer licensed in the Province of Manitoba for the redesign. The installed pipe must be capable of meeting the design flow. Plans showing the changes shall be submitted to the Contract Administrator for review.

(v) Perform a verification survey with a transit or total station of each of the installed pipe lengths from launching shaft to receiving shaft within 24 hours after the completion of the removal of the MTBM. Document measured

conformance to design line and grade of the pipe together with locations and deviation (distance and direction) of any out-of-tolerance locations.

(f) Launch and Retrieval: The Contractor shall implement appropriate procedures and notify the Contract Administrator immediately upon implementation of any contingency plan.

(g) Microtunnelling Operations: Contractor shall read all of the reports listed in the Project Conditions before commencing microtunnelling operations. A copy of each report contained in the Project Conditions shall be maintained in a secured location near the launch shaft. Contractor shall adhere to the following requirements and conditions:

(i) Conduct microtunnelling operations in accordance with applicable safety rules and regulations, and use methods that include due regard for safety of workers and protection for adjacent structures, utilities, and the public.

(ii) Monitor for hazardous gas conditions; if encountered, take appropriate steps to ventilate the work area.

(iii) Keep tunnel excavation within the rights-of-way indicated on the Drawings, within the lines and grades designated on the Drawings, and within the specified tolerances.

(iv) Equipment powered by combustible fuels shall be located at suitable distances from the shafts as per written instructions from the dedicated site safety representative. These instructions shall be made immediately available to the Contract Administrator upon request.

(v) Synchronize the rate of advance of the MTBM with the rate of spoil removed to limit ground loss or heave.

(vi) Operate the microtunnelling system within the operating parameters established in the specifications and accepted submittals.

(vii) Make the excavation of a minimum sufficient size to permit pipe installation by jacking in accordance with project conditions with allowance for injection of the lubricant.

(viii) Maintain an envelope of lubricant around the exterior of the pipe during jacking and excavation operation to minimize potential surface settlements as the ground squeezes into the annular space and to reduce the exterior friction acting against the pipe with the possibility of the pipe seizing in place.

(ix) Fluid jetting to advance the pipe is prohibited.

(x) If the pipe “freezes” and the MTBM and/or pipeline are unable to be moved, a rescue pit may be allowed with the location subject to review and acceptance by the Contract Administrator. Rescue pit construction shall be performed as specified herein.

(xi) In the event a section of pipe is damaged during the jacking operation or joint failure occurs, as evidenced by visible groundwater inflow or other observations, use one of the following procedures to correct the damage at no additional cost:

- Slightly damaged pipe that passes the specified leak acceptance testing and maintains pipe barrel and joint structural integrity may, if access is possible, be repaired in place with a method approved by the pipe supplier and if the proposed technique is accepted by the Contract Administrator. These actions shall be performed at the expense of the Contractor.
- Severely damaged pipe, or pipe where joint failure is evident, shall be removed from the excavation by surface excavation, by jacking the damaged pipe through the excavation and removing it at the receiving shaft, or by sinking a rescue shaft and removing and replacing damaged pipe. Do not begin a new drive until structural pipe monitoring system is implemented on all remaining drives. These actions shall be performed at the expense of the Contractor.

(xii) Perform contact grouting of the annular space as required to fill annular space, reduce embedment loads, and control settlement.

(h) Obstructions and Rescue Pits during Microtunnelling:

(i) Remove, clear, or otherwise make it possible for the microtunnelling equipment and pipe to progress past or through objects in accordance with the submitted contingency plan.

(ii) The object blocking the forward motion of the MTBM shall meet the definition of an obstruction and the following requirements shall be met:

- Notify Contract Administrator immediately upon encountering an object that prevents the forward progress of the MTBM.
- Proceed with removal of the object by means of obstruction removal procedures in accordance with the submitted contingency plan.
- The Contract Administrator shall be provided access to document the obstruction. No excavation within 5 feet of the microtunnelling equipment cutter wheel is to take place without the Contract Administrator being present.
- The Contractor shall have on hand at all times and readily available: equipment, tools, materials, and labor appropriate for the effective and efficient work related to obstruction removal.

(iii) The proposal of alternative methods for removing, clearing, or otherwise making it possible for the microtunnelling equipment to progress past objects that do not allow for the visual observation and measurement of the nature of the object shall not be considered for additional payment.

(i) Rescue pit:

(i) If a rescue pit is requested, obtain written authorization from the Contract Administrator before beginning construction of this pit. Contractor's request shall include all necessary permits and approvals, minimize public inconvenience, and minimize impacting existing facilities. Additional ground monitoring instrumentation shall be required.

E28.12 Sound Attenuation

(a) The City recognizes that long trenchless drives may require continuous operations, 24 hours per day, seven days per week during tunneling operations. The City will provide exemption to Neighbourhood Livability By-Law No. 1/2008 for critical and necessary tunneling operations required for this work. Work outside the times outlined in the By-Law will be restricted, including, but not limited to;

(i) Operation of equipment only critical to tunnel operations;

(ii) Use of equipment meeting stringent noise output requirements;

(iii) Use of sound attenuation barriers and devices;

(iv) Use of equipment, trucks and other machinery that do not conform to the Livability By-law for removal of spoils from site, bringing materials to site, or other purposes not deemed essential for the tunneling operation, shall be prohibited.

(v) Monitor the ambient noise at the corner of the occupied building closest to noise generating equipment including but not limited to generators, cranes, and slurry separation equipment.

(vi) Provide equipment with enclosures or construct portable sound barriers to minimize noise impact.

(vii) Provide a generator and other equipment with a “residential” silencer and acoustic enclosure. Provide equipment that continuously meets the noise requirements.

(viii) Provide equipment with mufflers, as needed, to mitigate the noise produced from construction.

(ix) Contractor shall be required to rearrange equipment to minimize noise impact as necessary.

(x) Construct Slurry plant enclosure to mitigate noise and cold weather when and where needed.

(b) For the purposes of determining normal background noise, Contractor to monitor nearest residential site on each side of the Red River for a period of one week. Establish a baseline using instrumentation to measured decibels for this period, and submit to the Contract Administrator prior to commencement of Work related to shaft construction and tunneling.

(c) For operations outside of restriction time frames set out in the By-Law (7:00 a.m. and after 9:00 p.m. on weekdays or before 9:00 a.m. and after 9:00 p.m. on Saturdays, Sundays and statutory holidays), the contractor shall maintain sound levels lower than;

(i) 50 dBA as measured on a one hour average;

(ii) 65 dBA as measured on a 15 minute average; and

(iii) 5 dBA over the monitored average background levels.

E28.12.1 Disposal of Muck and Excess Material

(a) Remove muck and excavated material from the project site and dispose of spoil as noted below.

(b) Locate and acquire a site for the legal disposal of muck and excess excavated material and dispose of same in accordance with all applicable laws and regulations.

E28.12.2 Site Cleanup

(a) Restore the site in accordance with the Contract Documents.

E28.12.3 Settlement/Heave

(a) Settlement/Heave: Ground deformations from microtunnelling shall be in accordance with the requirements contained in E37.

E28.12.4 Inflow through Entrance and Exit Seals

(a) Loss of seal at entrance and/or exit shall be characterized by leaking water, lubricant, or slurry through the seal in excess of 3 litres per minute and/or inflow of ground in excess of 0.025 m^3.

E28.12.5 Allowable Alignment Deviations and Return to Line and/or Grade

(a) Horizontal (Line): Do not exceed more than 120 mm from that depicted on the Drawings at any point along the alignment.

(b) Elevation (Grade): Do not exceed more than 120 mm from that depicted on the Drawings at any point along the alignment.

(c) When the excavation is off line or grade, return to the design line and/or grade over the remaining portion of the drive and at a rate of not more than 25 mm per 8 m.

E28.12.6 Surveys

(a) The qualified/professional surveyor for the Contractor shall conduct all of the surveys required for the Work. The Contract Administrator will provide location coordinates shown on the Drawings within five (5) days' notice of request for these coordinates. Attend a survey coordination meeting and adhere to the schedule established at that meeting.

E28.13 Measurement and Payment

(a) Supply and installation of the casing pipe via Microtunnelling will be paid on a Lump Sum basis at the Contract Price for "Installation of 2100 mm Casing Pipe".

(b) Payment for installation of the 2100 mm casing pipe will include but is not limited to the supply and installation of the casing pipe via microtunnelling including tunnel muck processing, removal and disposal of excavated material, and all necessary equipment, materials, labour and performing all operations necessary to complete the Work as specified and as indicated on the Drawings including all items incidental to the Work. No additional payment will be made.

E29. TUNNEL MUCK PROCESSING AND EXCAVATED MATERIAL DISPOSAL

E29.1 Scope of Work

E29.1.1 Contractor shall be responsible for the construction operations used on this project to include selecting the means and methods for processing microtunnelling muck and excavated materials in accordance with the requirements as contained in the Contract Documents.

E29.1.2 Contractor shall hire an environmental engineer (Contractor's Environmental Engineer) meeting the requirements as contained herein. Contractor is responsible for the work produced by this engineer.

(a) Contractor's Environmental Engineer shall be responsible for selecting acceptable disposal facilities that operates in compliance with all applicable laws and regulations for the various materials being excavated.

(b) Contractor's Environmental Engineer shall be responsible for the design of the storage areas, processing equipment and areas, testing, transportation to include off-haul, and disposal of the microtunnelling muck and excavated materials, to include any interstitial water, added slurry, and soil conditioning agent, shall be the responsibility of Contractor. Furnish any required sampling and testing of the muck and excavated materials including any necessary measures for interstitial water and/or gas readings in compliance with the governing regulatory requirements and the reviewed submittals to include any sampling and testing, as required, for the selected disposal facility.

E29.2 Submittals

E29.2.1 Submit the following in accordance with E4:

(a) Qualifications of Environmental Engineer. A minimum 5 years of experience with characterization, transportation, and disposal of waste materials.

(b) Plan for the Transportation and Disposal of Muck and Excavated Material. The Contractor's Environmental Engineer shall develop and sign the Plan for the Transportation and Disposal of Muck and Excavated Material in accordance with the requirements as contained herein. Contractor shall determine the consistency, quality, and quantity of muck and excavated materials generated as a result of construction activities at the site.

(i) The plan for the transportation and disposal of muck and excavated material shall include provisions for handling, characterization, and disposal of excess impacted soils-hazardous waste if encountered. Hazardous waste is material that is defined as hazardous waste by applicable regulations.

(ii) Provide complete details to include haul routes, detailed schedule, estimated number of trucks, processing areas, work hours, noise control, dust control, routine clean up procedures to include truck washing, regulatory testing requirements, and disposal facility testing requirements.

(iii) Provide copies of the regulations used in the development of the plan.

(iv) Contractor shall fully describe the means and methods to be used for each construction operation that generates muck and excavated material. Describe the equipment that will be used to generate, transport, process, and off-haul muck and excavated materials.

(v) Identify any slurry additives and/or soil conditioning agent that will be used.

(vi) Consideration shall be given to the ground and groundwater conditions as defined in the GBR. Describe the considerations that have been taken into account from the GBR and the means and methods of construction to evaluate the consistency, quality, quantity, and testing of the muck and excavated materials to be off-hauled and disposed.

(vii) Provide all supporting calculations and catalogue cuts including: the capacities of construction equipment handling and hauling soil volumes; each component

of the microtunnelling soil slurry processing, solids handling, plant to be utilized with each slurry microtunnelling boring machine (MTBM); etc.

(viii) Include contingency plans to provide added: handling and hauling capacities; and solids handling equipment to increase the soil slurry processing capacity each plan shall include the onsite storage of equipment, materials, power, and operations staff.

(ix) An MTBM manufacturer's letter certifying the MTBM maximum muck production rates for each drive.

(c) Erosion and Sediment Control Plan for the temporary storage and processing areas of muck and excavated material. Contractor's Environmental Engineer shall develop and sign an erosion and sediment control plan for temporary storage and testing of muck and excavated materials while temporarily stored and processed at the project site. All muck and excavated material on the site shall be temporarily stored and processed in accordance with the submitted erosion and sediment control Plan.

(i) Provide drawings and or describe temporary storage facilities, processing procedures, and storm water management measures to be implemented that meet or exceed all applicable regulations. Such information will be amended to the Storm Water Pollution Prevention Plan prior to starting work.

(ii) Furnish copies of the regulations used in the development of the plan.

(iii) Contractor shall determine the consistency, quality, and quantity for the generated muck and excavated materials temporarily stored and processed at each accepted site location.

(iv) Consideration shall be given to the ground and groundwater conditions as defined in the GBR. Describe the considerations that have been taken into account from the GBR and the means and methods of construction to evaluate the consistency, quality, quantity, and testing of the muck and excavated materials to be temporarily stored and processed at each site location.

(v) Provide all supporting calculations.

(d) Qualifications of the disposal facility to demonstrate legal compliance with all applicable regulations that govern the disposal requirements for the muck and excavated materials generated during construction.

(e) Certification by the disposal facility stating their agreement to accept the muck and excavated materials in accordance with the submitted Plan for the Transportation and Disposal of Muck and Excavated Material.

(f) Inspection reports as signed by Contractor's Environmental Engineer to include mitigation strategies for any deficiencies observed during inspection.

E29.3 Quality Control

E29.3.1 The disposal facility shall be a company that specializes in the disposal of earthen waste material with at least three (3) continuous years of operation.

(a) This facility shall demonstrate compliance with all applicable regulations.

(b) Disposal facilities shall furnish a certificate agreeing to accept the muck and/or excavated materials in accordance with the consistency, quality, quantity, and testing of the muck and excavated materials as described in the submitted Plan for the Transportation and Disposal of Muck and Excavated Material.

(c) This facility shall provide a ticket for each load accepted to the truck driver stating the material and quantity (tons) disposed. The facility shall have a truck scale, meeting appropriate certifications as evaluated by Contractor's Environmental Engineer, for stamping these tickets.

E29.3.2 Contractor's Environmental Engineer shall meet all regulatory requirements in the Province of Manitoba and have at least five (5) years of demonstrable experience in environmental engineering to include in-depth knowledge of applicable regulations.

E29.3.3 Tunnel muck processing shall require continual removal of microtunnel spoils, there shall be no overnight stockpiling of tunnel muck at the jacking shaft locations. Microtunnel muck processing shall not impede MTBM excavation progress. The microtunnel muck handling and hauling operations or processing plants for each drive shall be designed to provide a capacity that equals the MTBM manufacturers' recommendations for maximum muck production rates in the soil conditions described in the GBR. If the capacity of the handling and hauling operations or muck processing plants is exceeded by the MTBM then the Contractor shall implement the appropriate contingency plans.

E29.4 Construction

E29.4.1 Do not generate any muck or excavated material until all of the submittals have been reviewed.

E29.4.2 Use only slurry and soil conditioning agents as listed in the reviewed submittals.

E29.4.3 Perform all construction operations related to muck and excavated materials in accordance with reviewed submittals.

E29.4.4 Contractor's Environmental Engineer shall immediately report to the Contract Administrator any significant deficiencies observed during the routine inspection and develop a plan for mitigating any deficiencies to include the time needed for correction. Significant deficiencies include non-compliance with any applicable regulation.

E29.4.5 Maintain a clean and orderly work site.

E29.4.6 Muck shall be hauled dry as confirmed by paint filter tests. Hauling of wet muck is not permitted.

E29.4.7 Haul all temporarily stored muck and excavated material off-site daily or in accordance with reviewed submittals.

E29.4.8 Contractor shall be responsible for any contaminated ground or groundwater that results from construction operations.

E29.4.9 Properly handle materials in conformance with applicable regulations. Provide for the health and safety of personnel and visitors who may work with or be exposed to the contaminated materials.

E29.4.10 Maintain the following records:

(a) Shipping manifests and certified weight slips on excavated materials.

(b) Laboratory sample chain-of-custody records.

(c) Laboratory analyses and reports.

(d) Notification of regulatory agencies.

E29.5 Measurement and Payment

E29.5.1 Tunnel muck processing and excavated material disposal will not be measured for payment. Tunnel muck processing and excavated material disposal will be considered incidental to the Lump Sum Price for "Installation of 2100 mm Casing Pipe".

E30. REINFORCED CONCRETE MICROTUNNELLING PIPE

E30.1 Description

(a) This Specification shall cover the minimum requirements for Reinforced Concrete Pipe (RCP) to be installed using trenchless methods, including placement in shafts and connection sections.

(b) Reinforced concrete pipe meeting the requirements identified herein may be used for the following applications:

(i) Siphon casing pipe installed via microtunnelling

E30.2 General

(a) Prior to selecting RCP for installation, the Contractor shall take into account the properties of RCP, the means and methods that will be used to install the pipe, the specified leakage criteria as contained herein, and the ground and groundwater conditions as defined in the Geotechnical Baseline Report (GBR).

(b) The Contractor is responsible for selecting an acceptable pipe material to be installed without damage to either the pipe or the pipe joints using equipment selected by the Contractor for use in the ground and groundwater conditions as defined in the GBR that meets the specified leakage test requirements.

(c) Designs for RCP shall be produced, signed and sealed by a Professional Engineer licenced to practice in the Province of Manitoba. The Contractor is responsible for the work produced by this engineer.

(d) Contractor's Engineer shall evaluate the pipe design against all temporary load conditions due to handling, shipping, storage, transport, and trenchless installation. Design and furnish this pipe with additional strength, reinforcement, and wall thickness as necessary to withstand all temporary load conditions due to handling, shipping, storage, transport, and installation. The pipe shall be handled, shipped, stored, transported, and installed without damage.

(e) Contractor's Engineer shall evaluate the joint design/configuration against all temporary load conditions due to handling, shipping, storage, transport, and trenchless installation as well as ensuring that the joints meet the specified leakage criteria after installation. Design and furnish joints in this pipe that meet the specified leakage criteria and that safely withstand all temporary loading conditions due to handling, shipping, storage, transport, and installation. The pipe shall be handled, shipped, stored, transported, and installed without damage to the joints, and upon installation, the specified leakage criteria shall be met. Furnish joint cushions that meet or exceed pipe manufacturer recommendations.

E30.3 Submittals

E30.3.1 Submit RCP designs for review by the contract administrator in accordance with E4 a minimum of ten (10) Business Days prior to manufacturing or shipping of the RCP, whichever should come first and no later than twenty (20) Business Days prior to commencement of microtunnelling works. RCP designs shall be sealed and signed by a Professional Engineer, registered in the Province of Manitoba and experienced in the design of RCP for microtunnelling applications. RCP design submissions shall include the following:

(a) Pipe thickness and reinforcing design computations including all specified design checks identified in E30.4. Designs to be provided for all pipe and specials required to complete the installation. Identify design assumptions based on the GBR;

(b) Name and manufacturer of the RCP;

(c) Material properties used for design. Include relevant historical and demonstration testing data to confirm material properties used in design;

(d) Certification by Contractor's Engineer that the pipe is sufficient for installation, as indicated on the Drawings using trenchless installation methods as selected by Contractor for the ground and groundwater conditions as defined in the GBR.

(e) Qualifications of Contractor's licensed Professional Engineer.

(f) Other information that may reasonably be required by the Contract Administrator to confirm the RCP design proposed conforms to the specified requirements and design intent.

E30.3.2 Submit the following Shop Drawings in accordance with E4 a minimum of ten (10) Business Days prior to commencement of pipe manufacturing or shipping, whichever should come first and no later than twenty (20) Business Days prior to commencement of microtunnelling works: Shop Drawings shall contain the following minimum information:

(a) Shop Drawings showing pipe construction details to include length, wall thickness, reinforcement, manufacturing tolerances, pipe joint design and configuration, allowable angular deflection, compression rings, specials, location of grout ports, and other pipe appurtenances. Show method for closure of ports.

(b) IJS Specials: The lead and trailing pipe in front of and behind an IJS. Supply shop drawings each type of IJS Special to be used, complete with shop drawings that show details. The Special “A” is the pipe leading an IJS and the Special “B” is the pipe trailing the IJS during the jacking process.

(c) Qualifications of the pipe manufacturer.

(d) The pipe manufacturer shall certify that the ground and groundwater conditions, as defined in the GBR, as well as the installation methods, as selected by Contractor, have been reviewed prior to manufacturing the pipe.

(e) Manufacturer literature stating the handling, shipping, storage, transport, and installation recommendations for the pipe.

E30.3.3 Submit Quality Control Records in accordance with ASTM C1417 and E4 within ten (10) Business Days of manufacturing or completion of testing. In addition to the requirements of ASTM C1417, submit the following:

(a) Mill tests for reinforcing steel and steel joint components

(b) External joint bands conforming to ASTM A36;

(c) Cement conforming to ASTM C150;

(d) Aggregates conforming to ASTM A1064/1064M, and A615 as applicable;

(e) Pipe conforming to ASTM C1417

(f) Pipe joints conforming to ASTM C443

(g) Submit pipe manufacturer’s recordkeeping for maintaining quality control of the pipes during the fabrication and curing processes in accordance with E4, including but not limited to:

(i) Tracking methods;
(ii) Serial numbers;
(iii) Inspections; and
(iv) Physical test results.

(h) Submit pipe manufacturer’s control measures and manufacturing tolerances for:

(i) Straightness of pipe;
(ii) Squareness of pipe ends;
(iii) Smoothness of outside surface;
(iv) Inside and Outside diameter of pipe;
(v) Circumferential Uniformity; and
(vi) Roundness

E30.3.4 Submit results from proof of design test(s) results in accordance with E4.

E30.3.5 Submit an affidavit of compliance in accordance with E4.

(a) An affidavit of compliance signed by an officer of the pipe manufacturing company shall be provided stating that the pipe and fittings comply with this Specification and ASTM C1417.

E30.4 Design of Reinforced Concrete Pipe

E30.4.1 RCP shall be designed using direct design methods in accordance with the latest edition of ASCE 27 meeting the following requirements. Pipe installed in open installations (if required) shall be designed in accordance with ASCE 15:

(a) Pipe shall be designed for the following minimum failure modes under both long term and temporary loads including: handling, shipping, storage, transport, and installation of the sewer pipe in accordance with established practices, national standards, and the requirements as contained herein.

(b) Pipe designs shall consider the following failure modes:

(i) Flexural strength

(ii) Crack control

(iii) Diagonal tension

(iv) Radial tension

(c) Long term hydrostatic design criteria:

(i) Maximum External HGL: 231.60 m

(ii) Maximum Internal HGL: 231.60 m

(d) Long term external loads shall assume tunnel loading estimated in accordance with ASCE 27 assuming zero cohesion of the overburden soils.

(e) Additional reinforcement, strength of pipe, wall thickness, and provisions for joints shall be designed by Contractor and furnished as necessary to ensure the adequacy of the pipe for all temporary load conditions.

E30.4.2 Jacking forces:

(a) Assess and design the pipe for imparted axial forces due to the microtunnelling operations in accordance with ASCE 27.

(b) Imparted axial forces shall be evaluated based on the anticipated installation methods and the potential for eccentric loading. At a minimum, the following conditions shall be assessed:

(i) Full concentric contact;

(ii) Eccentric loading with full contract on bearing pad; and

(iii) Additional checks if partial contact is anticipated.

E30.4.3 The pipe shall be additionally designed by the Contractor to safely withstand all anticipated temporary loads due to handling, shipping, storage, transport, and installation of the sewer pipe in accordance with ASCE 27 and the requirements contained herein. Also account for contact grouting of the pipe after trenchless operations have been completed.

E30.4.4 If this pipe material cannot be manufactured with sufficient strength and/or wall thickness to withstand all of the handling, shipping, storage, transport, and trenchless installation loads, then this product shall not be considered suitable for installation on this project by trenchless methods. Furthermore, if the joints lack sufficient strength to withstand all of the handling, shipping, storage, transport, and trenchless installation loads or if the joints lack sufficient water tightness to meet the specified leakage criteria after installation, then this product shall not be considered suitable for installation on this project by trenchless methods.

E30.5 Materials

E30.5.1 Reinforced Concrete Pipe

(a) Reinforced Concrete Pipe shall be manufactured in accordance with ASTM C1417, CW 2130 and the minimum requirements as contained herein. The more restrictive of these criteria shall apply.

(b) Concrete Requirements

(i) A minimum 28 day concrete compressive strength: 41.4 MPa.

(ii) Pozzolan shall conform to ASTM C618.

(iii) Type HS cement shall be used

(c) Reinforcement Requirements

(i) Reinforcement for pipe intended for trenchless installations must take into account the potential for the pipe to rotate during installation. The design of stirrups and circumferential reinforcement must not result in a preferential installation orientation for the pipe unless appropriate controls are put in place, precluding rotation of the pipe during installation.

(d) Joint Requirements

(i) Pipe joints shall conform to ASTM C361.

(ii) Joint design shall be suitable for an internal/external hydrostatic head of 275 kPa when empty.

(iii) The use of external steel bell is required. The external steel bell shall not protrude past the outside of the pipe barrel. The use of steel spigot rings should be considered.

(iv) Joint bells shall be designed to accommodate joint deflection as a result of curves in alignment.

(e) Joint Bands

(i) External joint bands shall conform to ASTM A36.

(ii) External joint bands shall meet the following dimensions:

- Minimum width: 220mm.
- Minimum bell depth: 113mm.
- Minimum thickness: 12 mm

(f) Lubrication ports, at a minimum, shall be located every 10 m. Stagger ports at 12:00, 3:00, and 9:00 o'clock positions.

(g) Dimensions

(i) The pipes and joints shall be in accordance with the permissible variations contained in Appendix A of the ASCE 27, ASTM C361, and ASTM C1417 except as required below. The more restrictive of these criteria shall apply.

(ii) Pipe shall be supplied in nominal lengths. At least 90% of the total footage, excluding special order lengths, shall be furnished in nominal length sections.

(iii) The minimum wall thickness, measured at the bottom of the spigot gasket groove where the wall cross-section has been reduced, shall be determined from the maximum jacking loads.

E30.5.2 Quality Control

(a) The pipe manufacturer shall be a company that specializes in the production of reinforced concrete jacking pipes with at least ten (10) continuous years manufacturing reinforced concrete jacking pipe.

(b) Contractor's Engineer shall be a licensed Professional Engineer with registration in the Province of Manitoba having at least five (5) years of demonstrable experience in the design of reinforced concrete jacking pipe to include the various pipe joint assemblies used with jacking pipe.

(c) Do not manufacture any pipe until all relevant submittals have been reviewed and accepted by the Contract Administrator. Mark all pipe at the place of manufacture in accordance with Appendix A of the ASCE 27 and ASTM C1417. Place serial numbers on the pipe for unique identification.

(d) Inspect pipe as it is delivered from manufacturer. Immediately reject any pipe that has not been properly marked, shipped, or handled in accordance with the reviewed submittals or that does not meet the requirements as contained herein.

(e) Allow Contract Administrator access to inspect the shipping, handling, storage, transport, and installation of each pipe.

(f) Testing

(i) Pipes shall be tested in accordance with ASTM C1417. The compressive strength of the concrete shall be tested in accordance with ASTM C39.

Evaluate the properties of the pipe using ASTM C1417. Provide the results of this testing.

(ii) Pipe joints shall be tested in accordance with ASTM C443. Provide the results of this testing.

(g) Plant Inspections

(i) The Contractor shall afford the Contract Administrator every facility to access and inspect all plant to be provided, work to be performed, materials to be supplied and equipment or machinery to be installed.

(ii) Provide notice a minimum of ten (10) Business Days prior to manufacturing of pipe.

E30.6 Construction

E30.6.1 Packaging, Handling, Shipping, Storage and Site Transport

(a) Packaging, handling, shipping, storage, and site transport shall be done in accordance with the manufacturer's instructions and reviewed submittals. Do not ship until the pipe is marked in accordance with the requirements as contained herein. The pipes must be stored in accordance with reviewed submittals.

(b) Care shall be exercised in handling, storing, transporting and placing pipe to prevent damage. No interior hooks or slings shall be used in lifting pipe. All handling operations shall be done with an exterior sling or other device acceptable to the Contract Administrator.

(c) All rubber gaskets shall be stored in as cool a place as practicable, preferably at 20º C or less, and in no case shall the rubber gaskets be exposed to the direct rays of the sun for more than 72 hours.

E30.6.2 Installation

(a) The installation of pipe and fittings shall be the responsibility of Contractor in accordance with the minimum requirements as established in the project plans, specifications, pipe manufacturer's recommendations, and reviewed submittals. Do not damage pipe or pipe joints.

(b) Installation of pipe by trenchless methods shall conform to E28.

(c) Installation of pipe using open cut methods shall conform to the CW2130 and ASTM C1479 Type 2 installation except as modified herein:

(i) The pipe shall be laid and fitted together so that when complete, the pipe will have a smooth and uniform invert. The trench shall be free of water while the pipe is being installed. The excavation of the trench shall be fully completed a sufficient distance in advance so as not to interfere with the laying of the pipe.

(ii) The sand bedding shall be levelled such that it forms a continuous solid bedding for the full length of the pipe except at the midpoint of each pipe and at the joints. The middle third of the bedding shall be left uncompacted. A small groove shall be left at the midpoint to facilitate the removal of the sling after the pipe has been laid (if required). Grooves shall be filled with sand after the removal of the sling.

(iii) Once the pipe is placed, the bedding layer shall be compacted (except the middle third). Subsequent layers shall then be placed and compacted to meet the installation requirements.

(iv) Selection, placement and compaction of bedding materials shall conform to ASTM C1479, and the Construction Drawings. The Contractor shall ensure that disturbance of the pipe or damage to the pipe coating does not occur during sand bedding and backfilling operations.

E30.6.3 Pipe Handling

(a) Use methods in accordance with reviewed submittals and requirements as contained herein.

E30.6.4 Pipe Jointing

(a) Inspect pipe end, gasket, and sealing surfaces for damages.

(b) Clean ends of pipe and joint components.

(c) Apply joint lubricant to the bell interior surface and the rubber seals. Use only lubricants approved by the pipe manufacturer.

(d) Use suitable equipment and end protection to push the pipes together.

(e) Do not exceed forces as recommended by the manufacturer for joining or pushing the pipe.

E30.6.5 Contact Grouting

(a) After the pipe installation has been accepted by the Contract Administrator, perform contact grouting in accordance with E31.

E30.7 Measurement and Payment

(a) Supply of the 2100 mm Reinforced Concrete Microtunnelling Pipe will not be measured for payment. Supply of 2100 mm Reinforced Concrete Microtunnelling Pipe will be considered incidental to the Lump Sum Price for “Installation of 2100 mm Casing Pipe”. No separate measurement or payment will be made.

E31. CONTACT GROUTING FOR MICROTUNNELLING INSTALLATION

E31.1 Description

(a) This specification describes the minimum requirements for providing the contact grouting to be used with E28 Microtunnelling.

E31.2 General

(a) The Contractor’s Engineer shall be a licensed Professional Engineer with registration in the Province of Manitoba having at least five (5) years of demonstrable experience in the design of grout mixes. Experience and education shall be documented in a resume with a detailed description of the work actually performed on each reference project.

E31.3 Submissions

E31.3.1 Submit the following in accordance with E4.

(a) Grouting equipment to include layout of equipment during grouting operations.

(b) Calibration certificates for gauges, flow meters, and regulators.

(c) Applied pressure and estimated volume of grout per pipe or casing segment.

(d) Procedure to fill the annular space to help limit settlement and reduce long term embedment loads on the pipe. Provide procedure, schematic, equipment, layout, injection pressures, and design calculations.

(e) Provide estimated injection volumes and pressures, supported by calculations, for the anticipated soil conditions as well as control measures to prevent damage to the pipe or casing.

(f) MSDS for grout mix additives.

(g) Grout mix.

(h) Daily production records submitted no later than the beginning of the following work day.

E31.4 Materials

(a) A cementitious grout shall be utilized, designed to completely fill the annulus between the microtunnelling pipe and native rock formation.

E31.5 Construction

E31.5.1 Design

(a) Grout mix shall be designed by the Contractor's Engineer.

(b) Calculate grout pressures and determine effects of fluid pressure on pipe using a minimum factor of safety of 2.0.

(c) Stiffness, strength, injection pressure, and volume of the contact grout mix shall be compatible with the ground and groundwater conditions as described in the GBR as well as the pipe that is being grouted.

E31.5.2 Quality Control

(a) Contractor shall maintain logs of all grouting operations, including pressures, grout volumes, QA/QC testing. The Contractor shall submit all grouting logs and testing results within ten (10) Business Days of completion of the grouting works or upon receipt of testing results from the testing lab.

(b) Provide access to during contact grouting operations to record the pressure gauge, volumetric gauge, and position of the shut-off valve.

E31.5.3 Execution

(a) Inject grout at all of the ports in the new pipe string to completely fill the annular space between the pipe or casing and the ground.

(b) Perform contact grouting in accordance with reviewed submittals.

(c) Use calibrated flow meters, gauges, and regulators.

E31.6 Measurement and Payment

(a) Supply and installation of contact grouting will not be measured for payment. Supply and installation of contact grouting will be considered incidental to the Lump Sum Price for "Installation of 2100 mm Casing Pipe". No separate measurement or payment will be made.

E32. HDPE CARRIER PIPE

E32.1 Description

(a) This specification covers the supply, installation and testing of HDPE piping.

E32.2 Submittals

E32.2.1 Submit the following for the HDPE pipe in accordance with E4.

(a) Fusing technician qualifications.

(b) Manufacturer quality control program and testing plan.

(c) Manufacturer testing as per AWWA C906 Section 5:

(i) Dimensional tolerance - hourly

(ii) Ductility testing (bend-back or elongation at break) - daily

(iii) Tensile strength

(iv) Density - daily

E32.2.2 Design calculations sealed by an engineer registered in the Province of Manitoba for the installation of the proposed pipelines demonstrating acceptable loads on the final product (carrier) pipe:

(a) Axial bending stress for pull-in procedures, and any other locations where axial bending will be required.

(b) Unconstrained collapse during grouting procedures.

(c) Pull load, including pull back forces and axial tensile strengths.

E32.2.3 Construction Method and Sequence of Operations:

(a) Identify site staging, fusing setup, modifications to micro tunneling shafts required to pull 914 mm DR 11 HDPE into place, casing spacer installation, and any other description of pulling operation.

(b) Maximum applied axial tensile force calculations on both the casing and carrier pipes during pullback, including any assumptions to reduce forces during operation, in accordance with ASTM F1962 and assurance of integrity of the pipeline during pullback operations.

(c) Method of suspending, supporting, and directing pipe during pullback.

(d) Method to prevent the two (2) 914 mm DR 11 HDPE from twisting during pullback operation.

E32.2.4 Fittings

E32.2.5 Casing spacers

E32.2.6 Monitoring results from the annular grouting process

E32.3 Materials

E32.3.1 914 mm (36") IPS HDPE Pipe

(a) Conforming to latest version of AWWA C906.

(b) Pipe shall be manufactured with a minimum Dimension Ratio (DR) of 11.

(c) Resin shall be PE4710.

(d) Minimum cell classification of 445574C in accordance with ASTM C3350.

(e) Listed in latest version of Plastic Pipe Institute TR4.

(f) IPS dimensions.

E32.3.2 Fittings

(a) Lap-joint (stub-end) type flange adapters to ASTM F2880 and torquing to follow PPI TN-38.

(b) Minimum AWWA Class B Ductile Iron Backup Ring, flange bolt kits and gaskets.

(c) Electrofusion Fittings - Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2B.01A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

E32.3.3 Casing Spacers

(a) Contractor shall select a casing spacer that can support the weight of the pipe and any additional loading required to facilitate the grouting operation and facilitate installation of the carrier pipe.

(b) Minimum band thickness: 1.9 mm (14 Gauge).

(c) Minimum band width: 203.2 mm.

(d) Spacers shall carry two (2) secondary casing pipes, equally spaced within the primary casing pipe.

(e) Placement shall be every 1.8 m to 2.4 m or as recommended by the manufacturer.

(f) Approved products: Advanced Products & Systems or alternates per B7.

E32.3.4 Annular Grout

(a) The proposed annular grout shall have material properties that permit grouting to occur without voiding within the annulus.

(b) Grouts shall conform to the requirements of ACI 229 with a minimum compressive strength of 1.5 MPa.

(c) Grout parameters and mechanical properties shall be provided through demonstration testing in accordance with E31.

E32.4 Quality Control

E32.4.1 Testing and Plant Inspections

(a) The Contractor shall afford the Contract Administrator every facility to access and inspect all plant to be provided, work to be performed, materials to be supplied and equipment or machinery to be installed in accordance with the provisions of AWWA C906 Section 5.7.

(b) The Contractor shall provide notice of pipe manufacture a minimum of seven (7) Calendar Days prior to commencement for the purposes of scheduling plant inspections.

(c) The Contract Administrator reserves the right to conduct third party quality control testing.

E32.4.2 Dimensional Checks

(a) Notwithstanding AWWA C906, Section 5.4, dimensional checks shall be carried out for each and every pipe and fitting in the production run.

E32.4.3 Quality control for cementitious grouting materials shall conform to CSA A23.2, expect as modified herein:

(a) Confirm the viscosity of the grout mixture in accordance with CSA A23.2, Test Method 1B to ensure conformance with the submitted grouting plan and shear bond tests. Flow properties of grout shall be checked a minimum of once per production run, for every 25 m3, or once per 30 minutes, whichever is more frequent.

(b) Confirm the density of the grout mixture in accordance with CSA A23.2, Test Method 6C. Grout density shall be measured and recorded once per production run, for every 25 m3, or once per 30 minutes, whichever is more frequent. The density shall be maintained within +/- 10 % of the design density.

E32.5 Construction Methods

(a) Contractor to confirm proposed laydown and working areas prior to construction. Operating constraints for working in close proximity to Critical Water Infrastructure shall be adhered to as per E16.

E32.5.1 HDPE Jointing and Fusing

(a) Thermal butt fusing to be in accordance with ASTM F-2620.

(b) Use qualified personnel for all welding operations (butt-fusion jointing of polyethylene pipe).

(c) A guided side bend evaluation shall be completed prior to joining pipe by butt fusion in accordance with ASTM F3183. The side bend evaluation shall be performed on by each fusing technician and each of the fusion machines used for joining pipe once per project. The result of each evaluation shall be recorded and submitted to the Contract Administrator.

(d) Check the temperature and uniformity of temperature over the heating surface of the heating tool with a pyrometer on the first joint of the day and periodically during the day in accordance with Section 6.3 of ASTM Standard Practice F 2620 for “Heat Fusion Joining of Polyethylene Pipe and Fittings”. Select multiple checkpoints to ensure uniform surface temperature.

(e) Use a data logging device with the hydraulic joining equipment to record fusion parameters of pressure, temperature, and time for each joint. Data recording in accordance with ASTM F3124.

(f) Ensure pipe ends are clean and dry prior to commencing fusing and do not allow ends of pipe to become wet during fusion operation.

(g) During cold or inclement weather, provide adequate shelter over the pipe joining equipment while fusing for protection from the elements (i.e. cold, rain, or wind, etc.).

(h) Provide PE stub end ring at limits of each pipe section.

(i) Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends. Do not drag pipe in a manner which may scratch or otherwise damage the pipe.

E32.5.2 Electrofusion

(a) Join by electrofusion to ASTM F1290 and in accordance with manufacturer's recommendations at locations reviewed and approved by the Contract Administrator.

E32.5.3 Installation of the two (2) 914 mm DR 11 HDPE Carrier Pipes

(a) Provide blocking or skids to protect the pipe from damaging surfaces, when required.

(b) Provide excavations, shoring modifications and other means to provide access to the primary casing without exceeding short term bending radius of the HDPE pipe.

(c) Provide casing spacers when pulling pipe into casing. Casing spacers shall be installed at spacing shown on Drawings to support pipe without sagging when full of water, prior to annular grouting.

(d) Prevent the two (2) 914 mm DR 11 HDPE Carrier Pipes from twisting during the pullback operations.

(e) A weak line or breakaway connector shall be used to prevent excess pulling force from damaging the product, and shall be designed using pipe properties consistent with the intended pullback duration.

(f) Allow the 914 mm DR 11 HDPE Carrier Pipes sufficient time to contract from both the pulling operation and thermal changes (e.g. shrinkage) prior to cutting to final length.

(g) Prior to annular grouting, pipe shall be filled with water to resist floatation and overheating due to cement hydration.

E32.5.4 Hydrostatic Leakage Testing

(a) Prior to installing pipe, each completed segment of HDPE pipe shall be pressure tested. Pipeline shall be visually assessed for leaks during test phase.

(b) Post pulling installation testing shall be completed a minimum of 24 hours after installation to permit pipe relaxation after pull. Post installation test shall be completed before annular grouting. End flanges shall be installed prior to testing.

(i) Test pressures are in reference to the lowest elevation of the HDPE pipe, approximately ground elevation at the Siphon Chambers of 231 m AD.

(c) Test Procedure

(i) Pressure test shall be recorded as per CW 2125.

(ii) Expansion phase pressure shall be 310 KPa (45 psi).

(iii) Test phase pressure shall be 240 KPa (35 psi).

(iv) The test section should be completely filled with the test liquid, taking care to bleed off any trapped air. Venting at high points may be required to purge air pockets while the test section is filling. Venting may be provided by bleed valves or equipment vents.

(v) The test procedure consists of initial expansion, and test phases. For the initial expansion phase, the test section is pressurized to test pressure and make-up test liquid is added as required to maintain maximum test pressure for four (4) hours. For the test phase, the test pressure is reduced by 70 KPa (10 psi). This is the target test pressure. If the pressure remains steady (within 5% of the target test pressure) for one hour, leakage is not indicated.

(vi) If leaks are discovered, depressurize the test section before repairing leaks. Leakage at a butt fusion joint may indicate imminent catastrophic rupture. Depressurize the test section immediately if butt fusion leakage is discovered. Leaks at fusion joints require the fusion joint to be cut out and redone.

(vii) If the pressure leak test is not completed due to leakage, equipment failure, etc., the test section should be de-pressurized and repairs made. Allow the test section to remain depressurized for at least eight (8) hours before retesting.

E32.5.5 Annulus Grouting

(a) The annulus between the HDPE carrier pipes and RCP casing pipe shall be fully grouted upon completion of the HDPE pipe installation and hydrostatic leakage testing.

(b) Carry out annulus grouting in accordance with reviewed grouting protocol submission. Ensure deflection limited and displacement of the HDPE carrier pipes does not occur during the grouting process.

(c) The Contractor is responsible for confirming that annulus is fully grouted.

(d) Grouting shall be completed in stages through the use of preinstalled grouting pipes within the annular space. Grouting ports may not be installed in the HDPE carrier pipe.

(e) General grouting requirements:

(i) Estimate the volume of grout required, including an overfill allowance based on grout properties, pipe cross sectional, and previous experience with grout mixture;

(ii) Minimize infiltration (or its effects) to the extent required to successfully complete the grouting operations;

(iii) Provide air vents at the high points;

(iv) Monitor and record the injection pressures at point of injection; and

(v) Monitor and record the volume of grout injected and compare with the estimate (with due consideration of an overfill allowance).

(f) Bulkheads:

(i) Bulkheads shall be constructed at the termination of the casing pipe to facilitate grouting and shall be temporary or permanent in nature.

(g) Pressure monitoring during grouting

(i) The Contractor shall keep the HDPE carrier pipe ballasted with water throughout the grouting process.

(ii) Monitor and record the internal pressure of the HDPE carrier pipe throughout the grouting process.

E32.5.6 Pipeline Inspection

(a) Complete a post installation pipeline inspection of the installed HDPE carrier pipe in accordance with E18. SONAR inspection shall occur after completion of the grouting operation.

E32.6 Measurement and Payment

(a) Supply and installation of the two (2) 914 mm DR 11 HDPE Carrier Pipe will be paid on a lump sum basis at the Contract Price for “Installation of HDPE Carrier Pipes”.

(b) Payment for installation of the 914 mm DR 11 HDPE Carrier Pipe will include but is not limited to the supply and installation of the carrier pipe, annular grouting, supply and install of casing spacers, hydrostatic leakage testing, and all necessary equipment, materials, and labour required to complete the work. No additional payment will be made.

(c) Temporary fittings for hydrostatic leakage testing will not be measure for payment. Supply and installation of temporary fittings for hydrostatic leakage testing will be considered

incidental to the Lump Sum price for “Installation of HDPE Carrier Pipes”. No additional payment will be made.

(d) Supply and installation of permanent Siphon Chamber HDPE Fittings shall not be measured for payment. Supply and installation of Siphon Chamber HDPE Fittings will be considered incidental to the Lump Sum price for “Chamber Piping”.

E33. CONSTRUCTION OF SIPHON CHAMBERS

E33.1 Description

(a) This Specification shall cover the construction of the two new reinforced concrete siphon chambers as shown on the Drawings.

E33.2 Materials

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

E33.2.1 Plastic Fabrications

(a) Plastic fabrications shall conform to E22.

E33.2.2 Metal Fabrications

(a) Metal Fabrications shall conform to E22.7(a).

E33.2.3 Concrete

(a) Concrete mix design shall be as indicated in the Construction Notes on the Drawings and in accordance with CW 2160 and E23.4(a).

E33.2.4 Reinforcing Steel

(a) Reinforcing Steel shall conform to CW 2160 and E24.5(a).

E33.2.5 Grout

(a) Grout, if required, shall be Sika Grout 212 or CPD Non Shrink Grout or approved equal in accordance with B7, mixed and applied in accordance with the manufacturer’s instructions and of a consistency suitable for the intended application, as accepted by the Contract Administrator.

E33.2.6 Foundation Waterproofing

(a) Foundation waterproofing shall conform to CW 2160.

E33.2.7 Valve Box Sealant

(a) Sealant for the valve box flange shall be a general purpose butyl sealant rated for buried and exterior locations.

E33.2.8 Joint Fillers

(a) Joint Fillers

(i) Joint filler for concrete slab shall be self-leveling, polyurethane sealant to meet requirements of ASTM C920, Type S, Grade P, Class 25, Use T, M, A, O, and I.

(ii) Approved product: Vulkem 45 as manufactured by Tremco, Sikaflex 1C SL, or approved equal in accordance with B7.

(b) Backer rod shall meet requirements of ASTM C1330.

(c) Bond Breaker: pressure sensitive plastic tape, which will not bond to sealants.

(d) Joint Cleaner: xylol, methylethyleketon or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

E33.2.9 Concrete Protection

(a) Concrete Protective Liners and Coatings shall conform to E25.4(a).

E33.2.10 Floor Hatches

(a) Floor Hatches: Cover and frame shall be aluminum. Hinges: Type 316 stainless steel. Slam lock with fixed interior handle and removable exterior turn and lift handle with removable gasketed screw plug, factory installed recessed padlock hasp, lift assistance and automatic hold open device: Type A316 stainless steel. All hardware to be Type 316 stainless steel. All hatches exposed to ambient temperatures shall be insulated with 50 mm of concealed polystyrene foam.

(b) Approved Products:

(i) Bilco Type J-AL, or approved equal in accordance with B7.

E33.2.11 Davit Mount Sleeve and Cap

(a) Davit mount sleeve shall be DBI Sala Advanced Flush Floor Mount Sleeve, Model # 8512828, stainless steel construction.

(b) Cap shall be DBI Sala Advanced Heavy Duty Sleeve Cap, Model #8510827, stainless steel construction.

E33.2.12 Access Ladders

(a) Ladder shall be fabricated from FRP, Aluminum, or stainless steel.

(b) Ladder dimensions as noted on the drawings.

E33.2.13 Extendable Ladder Up-Post:

(a) Approved Product: Ladder Up Safety Post LU-3 (stainless steel) by Bilco. Provide one ladder up-post for each surface access ladder.

E33.3 Construction Methods

E33.3.1 Excavation

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

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

E33.3.2 Backfill

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

(b) Notify the Contract Administrator at least one (1) full working day in advance of any backfilling operation. No Backfill shall be placed against concrete until accepted by the Contract Administrator and in no case before field cured test cylinders show the concrete strength to be 75% of the specified 28 day strength.

E33.3.3 Grout

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

E33.4 Measurement and Payment

(a) Construction of the siphon chambers will be measured on a Lump Sum Basis and paid at the Contract Price for “Construction of Siphon Chambers” for each chamber as listed in Form B: Prices.

(b) Payment shall include but not be limited to:

(i) All necessary labour and materials to complete the work as specified herein;

(ii) Supply and installation of reinforcing steel;

(iii) Supply and installation of cast-in-place concrete;
(iv) Supply and installation of grating;
(v) Supply and installation of metal fabrications including ladders, access hatches, etc.;
(vi) Supply and installation plastic fabrications;
(vii) Construction of structural chamber walls (if required);
(viii) Construction of floor slabs; and
(ix) Construction of chamber projection to grade;

E34. CHAMBER PIPING

E34.1 Description

(a) This Specification shall cover the supply and installation of chamber piping and appurtenances installed within the proposed inlet and outlet chambers.

E34.2 Submittals

E34.2.1 Submit Shop Drawings for all piping components in accordance with E4.

E34.2.2 Submit a detailed laying schedule for the 750 mm Fibreglass chamber piping in accordance with E4. A three dimensional model is recommended to properly account for the required angular rotation.

E34.3 Materials

E34.3.1 Fasteners

(a) Flange bolt size, type and diameter shall be in accordance to AWWA C207. Bolt length suitable for coupling AWWA C207 Class B flange.

(b) Bolts for all chamber piping shall be ASTM F593 or ASTM F738M, type 316 stainless steel.

(c) Nuts for all chamber piping shall be ASTM F594 or ASTM F836M, type 316 stainless steel.

(d) Anti-seize compound shall be used on all bolts.

E34.3.2 Flange Gaskets

(a) 3mm, full-faced, SBR rubber gaskets or neoprene in accordance with AWWA C207.

(b) Gaskets shall be one piece construction where possible.

(c) Segmented gaskets shall be constructed of a minimum number of segments and joints shall be of dovetailed construction, or other jointing methods accepted by the Contract Administrator.

(d) For flange connections to FRP pipe, use O-ring gaskets as per FRP manufacturer recommendation

E34.3.3 Large Diameter Chamber Pipe (750 mm and larger)

(a) Large diameter Fibreglass pipe shall be manufactured in accordance with, AWWA C950, and ASTM D3754.

(b) Pipe shall be Outside Diameter controlled dimensions.

(c) Pipe shall have a stiffness number of SN 36 psi (minimum)

(d) Pipe shall be designed for a minimum operating pressure of 350 Kpa(50psi), pressure class designation of C50 in accordance to ASTM D3754

E34.3.4 Chamber Fittings

(a) Fabricated FRP fittings manufactured to AWWA C950.

(b) Fabricated elbows may utilized mitered bends. Mitered bends shall meet the following:

(i) 30 deg to 45 deg elbow – Minimum 3 segment construction

(ii) 60 deg to 90 deg elbow – Minimum 4 segment construction

E34.3.5 Blind Flanges

(a) Blind flanges for FRP systems shall have drilling pattern as per AWWA C207/ANSI B16.1, minimum pressure class PN50. AWWA C207 Class B.

(b) Cast and ductile blind flanges shall be ASME/ANSI B16.1 Class 125.

(c) Interior and exterior coatings on metal flanges shall be in accordance with AWWA C210

E34.3.6 Flanges

(a) Flanges for FRP chamber pipe and fittings shall conform to AWWA C950, minimum pressure PN50.

E34.3.7 Vent Piping (150 and 200 mm)

(a) Steel vent pipe conforming to AWWA C200 or ANSI B16.5. Steel pipe must meet the following:

(i) Minimum steel yield strength: 240 MPa (35,000 psi).

(ii) Minimum wall thickness: Schedule 40.

(iii) Stainless Steel 316.

(b) Flanges for Vent pipe and fittings shall conform to AWWA C207 Class B or ANSI B16.5 - Class 150.

E34.3.8 Sleeve Couplers and Dismantling Joints

(a) Pipe couplings shall conform to AWWA C219.

(b) Unless otherwise specified, center sleeves for pipe couplings shall be constructed from steel.

(c) Minimum requirements for sleeve couplings are:

(i) Minimum centre sleeve length: 175 mm (7”).

(ii) Centre sleeve thickness for steel couplings: 9.5 mm.

(iii) Couplings capable of accommodating up to 2 degrees deflection.

(iv) Design pressure 150 psi.

(d) All hardware shall be type 316 stainless steel in accordance with E34.3.1.

(e) Couplings to be supplied complete with a fusion bonded epoxy coating in accordance with AWWA C213. NSF 61 certification not required. The final minimum coating thickness shall be the greater of 10 mils or as recommended by the manufacturer for submerged applications.

E34.3.9 Stainless Steel Ball Valves

(a) Stainless steel flanged ball valves shall be stainless steel valves complete with Stainless Steel ball, ASME B16.1 CLASS 125 flanges and stem.

(b) Acceptable product: Series 4001 as manufactured by American Valve Inc. or approved equal in accordance with B7.

E34.3.10 Flange Insolation Kits

(a) Flange isolation kits shall be used where noted, where dissimilar metal piping or fittings are joined.

(b) Flange isolation kits shall be to City of Winnipeg specification except as modified below.

(c) Each kit shall be double flange isolation kit with insulating sleeves and washers for each flange of the bolted connection.

(d) Bolt sleeves shall be comprised of G10 or G11 epoxy glass.

E34.3.11 Pipe Supports

(a) Construct as shown on Drawings.

(b) Steel components to be Type 316 Stainless Steel.

(c) FRP Supports and Anchors per manufacturer recommendations.

(d) U-Bolt shall meet the requirements of E34.3.1.

(e) U-Bolts and nuts shall be Type 316 Stainless Steel.

E34.4 Hydrostatic Leakage Testing

(a) Undertake a hydrostatic leakage test upon complete installation of Chamber Piping, to a minimum of the following installations:

(i) All chamber piping below 231.2 m in the upstream (west) chamber and 229.2 m in the downstream (east) chamber.

(ii) Stainless steel knife gates, undertake a hydrostatic leakage test of the entire crossing by:

- 914 mm DR 11 HDPE including annular grout
- Close stainless steel knife gates

(b) The test shall be completed as follows:

(i) Hydrostatic leakage test shall be recorded as per CW 2125.

(ii) Fill system to an elevation of 228 m.

(iii) The test section should be completely filled with the test liquid, taking care to bleed off any trapped air. Venting at high points may be required to purge air pockets while the test section is filling. Venting may be provided by bleed valves or equipment vents.

(iv) The test procedure consists of initial expansion, and test phases. For the initial expansion phase, the test section is pressurized to test pressure and make-up test liquid is added as required to maintain maximum test pressure for four (4) hours. If the pressure remains steady (within 5% of the target test pressure) for one hour, leakage is not indicated.

(v) If leaks are discovered, depressurize the test section before repairing leaks.

(vi) If the pressure leak test is not completed due to leakage, equipment failure, etc., the test section should be de-pressurized and repairs made. Allow the test section to remain depressurized for at least eight (8) hours before retesting.

E34.5 Measurement and Payment

(a) Supply and installation of chamber piping shall be measured on a Lump sum basis and paid for at the Contract Lump Sum Price for “Chamber Piping” as listed in Form B: Prices.

(b) Hydrostatic leakage testing will not be measured for payment. Hydrostatic leakage testing will be considered incidental to Chamber Piping. No additional payment will be made.

E35. STAINLESS STEEL KNIFE GATE VALVES

E35.1 Description

(a) This specification covers the supply, installation and testing of knife gate valves.

E35.2 Submittals

E35.2.1 Submit Shop Drawings in accordance with E4.

(a) Provide Affidavit of Compliance, certifying that the gate valve conforms to the requirements of AWWA C520 and this Specification.

(b) Data for gate and actuator characteristics and performance.

(c) Installation instructions.

(d) Operation and Maintenance Manual.

E35.3 Materials

E35.4 Stainless Steel Knife Gate Valves

(a) Provide four (4) 750 mm (nominal) Stainless Steel Knife Gate valves, complete with stainless steel bolts and two (2) face gaskets per valve.

(b) Stainless steel knife gate valves conforming to AWWA C520.

(c) Laying lengths shall conform to AWWA C520.

(d) Valve body, gate, and all support structures shall be constructed from stainless steel.

(e) Stainless steel shall conform to ASTM A351, type 316 or ASTM A240, type 316.

(f) All hardware to be type 316 stainless steel.

(g) Provide enclosed stem guard to protect shaft from debris accumulation in open position.

(h) The valve stem shall be a non-rising configuration fitting with a 50 mm AWWA operating nut, on top of shaft for connection of extension shaft.

(i) AWWA C207 Class B (minimum) Flange.

(j) Designed for following operating conditions:

(i) Normally open.

(ii) Closed during hydrostatic leakage test: Hydraulic Grade Line of 231 m on siphon (river) side, open channel flow conditions on sewer side (DWF as shown on Drawings).

- The valve shall be watertight to facilitate regular leakage test of siphon crossing for regulatory reporting.

(iii) Closed for maintenance conditions: Hydraulic Grade Line varying between DWF and WWF (25 yr) as shown on drawings on sewer side and empty on siphon side.

(k) Approved product: Dezurik KGC-ES (with resilient seat) or approved equal in accordance to B7.

E35.4.1 Manual Operators

(a) Provide a manual hand wheel gate operator on a floor stand on the intermediate floor of the siphon chamber.

(b) Gearing and Enclosure

(i) Gate operator shall be supplied complete with gear reduction as required to operate gates under the operating head and design head, as specified and indicated, with no greater than a 177 N effort on the hand wheel.

(ii) Number of actuator turns to open or close the valve shall be kept to as few as possible to avoid over torquing and damage to the actuator.

(iii) The gearing enclosure shall have a submersible rating equal to IP68.

(c) Input Limit Stops

(i) Adjustable, external stop-limiting devices shall be provided on the actuators to prevent over-travel of the valve disc in the open and closed position.

(ii) Under circumstances where spur gear attachments are installed on the input side of the actuator to facilitate the maximum input operating torque of 356 Newtons (80 ft. pounds), input limit stops shall be installed on the input side of the spur gear attachment.

(iii) A shear pin or other torque regulating device shall be provided on the actuator or handwheel/operating nut as an extra precaution against actuators being over-torqued.

(d) Protective Coatings

(i) All external ferrous metal components including adaptor and mounting plates, shall be fusion bonded coated in accordance with AWWA C213, AWWA C550. NSF 61 certification is not required. The final minimum coating thickness shall be the greater of 10 mils or as recommended by the manufacturer for submerged applications.

(ii) Any touch-up paintwork required during installation shall be undertaken by the installation contractor. The touch-up paint shall be of the same colour and compatible with the coating utilized for the floor stand operator.

(e) Handwheel

(i) Each actuator shall be equipped with a 450 millimetre (min.) to 600 millimetre (max.) diameter handwheel fitted with an operating nut secured in position by a lock nut, pin or key. The handwheel shall be made of cast iron or aluminum of the rimmed type with finger grips, an arrow, the word "OPEN" cast in relief on the rim and have an easy slide fit onto the mating shaft. Direction of opening shall be counter clockwise.

(ii) The handwheel shall be located sufficiently away from the valve flanges, housings, etc. such that personnel will not hit their knuckles on any of these obstructions when using the handwheel.

(f) Provide mechanical seals on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist mechanism.

(g) Provide lubricating fittings for the lubrication of all gears and bearings.

E35.4.2 Valve Stems:

(a) A 50 mm diameter stainless steel extension shaft shall be supplied for surface operation as shown on the Drawings.

(b) The extension shaft shall be configured for a 50 mm AWWA operating nut.

(c) The extension shaft shall be sized to facilitate use of the position indicators and located a minimum of 150 mm and maximum of 300 mm from the proposed final grade.

E35.4.3 Valve Box Mounted Position Indicator

(a) Valve Box mountable.

(b) Non-rising stem position indicator.

(c) Suitable for a 50 mm AWWA Operating Nut.

(d) Approved products: Dynatorque Model GPI, Trumbull Valve Position Indicator, or approved equal in accordance with B7.

E35.5 Installation

E35.5.1 Provide manufacturer representative to attend valve commissioning. Allow 4 hours for on-site commissioning services.

E35.6 Measurement and Payment

(a) Supply and installation of Knife Gate Valves will not be measured for payment. Supply and installation of Knife Gate Valves including valves, floor stands, gearboxes, handwheels, shaft extensions and any associated materials and work require for the installation will be considered incidental to the Lump Sum price for “Chamber Piping”. No additional payment will be made.

E36. ALUMINUM STOP LOGS

E36.1 Description

(a) This specification covers the supply, installation, and testing of stop logs.

E36.2 References

(a) Aluminum Association (AA):
  (i) ASM35: Aluminum Construction Manual.
  (ii) H35.1: Aluminum Alloy and Temper Designation.

(b) American Society for Testing and Materials International (ASTM):
  (i) D2000: Standard Classification System for Rubber Products in Automotive Applications.
  (ii) D4020: Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials.

(c) American Welding Society Code (AWS):
  (i) D1.2: Structural Welding Code – Aluminum.

(d) Canadian Standards Association (CSA):
  (i) Welding Procedure Specifications.

E36.3 Submittals

(a) Submit the following Shop Drawings in accordance with E4:
  (i) Certified shop and erection drawings. The Contractor shall submit electronic files of the proposed equipment in the capacity, size, and arrangement as indicated and specified.
  (ii) Data for stop log characteristics and performance.
  (iii) Complete description of all materials, material thicknesses of all components.
  (iv) Maximum bending stress and deflection of the stop logs under design head specified and indicated.
  (v) Installation drawings showing the details required for installation, dimensions, clearances and anchor bolt locations.
  (vi) Shop Drawing data for accessory items.
  (vii) Certified setting plans, with tolerances, for anchor bolts.
  (viii) Manufacturer's literature as needed to supplement certified data.
  (ix) Operating and maintenance instructions and parts lists.
  (x) Shop and field inspection reports.
  (xi) Qualifications of field service engineer.
  (xii) Recommendations for short and long-term storage.
  (xiii) Field testing procedures and set up.
  (xiv) Special tools.
  (xv) The latest ISO 9001 series certification or quality system plan.

E36.4 Spare Parts

(a) One (1) set of all special tools is required.

E36.5 Quality Assurance

(a) Stop logs shall be the product of one manufacturer.

(b) Stop logs shall be manufacturer’s standard cataloged product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.

(c) Welding: In accordance with latest applicable American Welding Society Code, ASME Welding Code, or equivalent.

(d) The Contractor shall obtain the stop logs, guide frames and appurtenances from the stop log manufacturer, as a complete and integrated package to ensure proper coordination and compatibility and operation of the system.

(e) Arrange for a qualified field representative of the stop logs supplier/manufacturer to be present during installation and field testing of stop logs.

(f) Manufacturer of stop logs shall have a minimum of ten (10) operating installations with stop logs of the size specified or larger and in the same service and head as specified operating for not less than five (5) years or manufacturer of stop logs shall utilize assign a Manufacturer Representative that is experienced in stop log design and construction. The Manufacturer Representative shall be an employee of the gate manufacturer and shall have designed a minimum of ten (10) operating installations with stop logs of the size specified or larger and in the same service and head as specified operating for not less than five (5) years.

E36.6 Products

E36.6.1 System Description

(a) Locations and Dimensions – As Shown on Drawings:

(i) Discharge Chamber

- Clear Opening: 3660 mm
- Height of stop log assembly: 1230 mm in height
- Height of frame: 4230 mm
- One (1) set of stop logs required. One (1) set of guide frames required. One (1) lifting device required.

(ii) Upstream (West) Siphon Chamber

- Clear Opening: 1922 mm
- Height of stop log assembly: 844mm in height
- Height of frame: 4844 mm
- One (1) set of stop logs required. Two (2) sets of guide frames required. One (1) lifting device required.

(iii) Downstream (East) Siphon Chamber

- Clear Opening: 1900 mm
- Height of stop log assembly: 897 mm in height
- Height of frame: 4197 mm
- One (1) set of stop logs required. Two (2) sets of guide frames required. One (1) lifting device required.

(b) Manufacturers

(i) Stop Logs:

- Fontaine Aquanox Water Control Gates.
- Waterman Industries.
- Approved equal per B7.

E36.6.2 Stop Log Construction

(a) Provide all stop logs produced by a single manufacturer and designed for installation in the channels and structures as specified and indicated.

(b) Stop log Configuration, Dimensions and Characteristics: As shown on Drawings and as specified herein.

(c) Leakage Rate: Not to exceed 1.25 L/min per metre of wetted seal perimeter.

(d) Provide the stop logs with a continuous resilient seal along the bottom and both sides. Seals on or within the guide frames are not acceptable.

(e) Stop Log Height: As indicated and designed to function as specified and indicated when stacked in any order.

(f) Provide all structural components of the stop logs fabricated of aluminum and with strength to prevent distortion during normal handling, during installation and while in service as specified and indicated.

(g) Provide all structural components of the guide frames fabricated of aluminum with strength to prevent distortion during normal handling, during installation and while in service as specified and indicated.

(h) Provide all welds performed by welders with AWS D1.2 certification for aluminum.

(i) Finish: Mill finish

(i) Provide welds on aluminum cleaned to provide a uniform finish.

(j) Materials:

(i) Stop Logs: 6061-T6 Aluminum.

(ii) Frame Guides and Invert: 6061-T6 Aluminum.

(iii) Lip Seal: Urethane ASTM D4020, Neoprene ASTM D2000 or EPDM.

(iv) Fasteners, Nuts and Bolts: ASTM A276 Type 316 stainless steel.

- Anchor Bolts: Minimum 1/2-inch (13 mm) diameter.

E36.7 Stop Logs

(a) Provide stop logs constructed of extruded aluminum shapes with a minimum thickness as specified below or as required for the head as indicated herein:

(i) Aluminum: 6 mm.

(b) Provide stop logs to achieve elevations shown on drawings:

(i) Discharge Chamber:

- Three (3) 300 mm tall
- One (1) 330 mm tall

(ii) Upstream Siphon Chamber

- Two (2) 300 mm tall
- One (1) 244 mm tall

(iii) Downstream Siphon Chamber

- Two (2) 300 mm tall
- One (1) 297 mm tall

(iv) Maximum Bending Stress: Not to exceed 553 MPa for aluminum at the maximum operating head.

(c) Provide stop logs designed to prevent buoyance and to allow drainage.

(d) Provide two (2) slots in the top of each stop log for removal and installation by means of the specified stop log lifter.

(e) Provide each stop log with a identification tag as follows:

(i) 3.2 mm 3 Ply Lamacoid.

(ii) 150 mm x 75 mm Matte Black / White 12 mm Tall Text.

(iii) 4 5 mm Diameter Holes and Adhesive Backing.

(iv) Routed (Chamfered) Edges.

(v) Indicating the following:

- Asset Number: S-XXXXXXXXXX (to be provided during construction).
- Location: Upstream / Downstream.

E36.8 Seals

(a) Provide stop logs with a continuous resilient seal along the bottom and both sides to restrict the leakage to the rate specified.

(b) Provide all seals of urethane or rubber, replaceable and mechanically retained to the stop logs.

E36.9 Frames

(a) Provide frame guides or grooves and invert members constructed of aluminum with a minimum thickness of 6 mm.

(b) Provide frame design to allow for embedded mounting.

(c) Provide a flush bottom invert member across the bottom of the guides.

E36.10 Stop Log Lifter

(a) Provide one (1) stop log lifter for each Chamber (total of three (2) required).

(b) Provide the lifter constructed of aluminum or Type 304L stainless steel and fitted with UHMW guide bars and stainless steel fasteners.

(c) Provide the lifter with lifting hooks designed to engage the slots in the top of the stop logs.

(d) Provide a lanyard release.

(e) Provide the lifter capable of installing and removing all stop logs of the same width whether they are installed or at the operating floor level.

E36.11 Execution

E36.11.1 Installation

(a) Install items in accordance with Shop Drawings, manufacturer's printed instructions and as indicated.

(b) Clean debris, dirt, and gravel, from inside of stop logs, guide frames and channels before placing stop logs.

(c) Install guide frames in a true vertical position and grout all voids between guide frames and walls.

(d) Inspect material for defects in workmanship and material.

E36.12 Field Testing

(a) Visual inspection to be completed in the presence of the Contract Administrator and a qualified field representative from the manufacturer/supplier.

(b) After installation of guide frames, and after inspection, operation, testing and adjustment have been completed by the manufacturer’s field service technician, conduct operating test for each stop log in presence of the Contract Administrator to determine its ability to operate as specified, and to operate smoothly without jamming under specified conditions.

(c) Test installation and removal of each stop log location with the number of stop logs as indicated.

(d) Immediately correct or replace all defects or defective equipment revealed by or noted during tests at no additional cost to The City.

(e) Repeat tests until specified results are obtained.

(f) Make all adjustments necessary to place equipment in specified working order at time of above tests.

(g) Remove and replace equipment at no additional cost to the City with equipment that will meet all requirements specified and indicated if unable to demonstrate to the satisfaction of the Contract Administrator that equipment will perform the service specified, indicated and as submitted.

E36.13 Measurement and Payment

(a) Supply and installation of aluminium stop logs shall be measured on a Unit Price basis for each aluminium stop log assembly in each chamber installed. Payment will be made at the Contract Unit Price for “Aluminium Stop Logs” as listed in Form B: Prices.

(b) Payment shall include supply and installation of frames, stop logs, seals, stop log lifter and any associated materials and work required for the installation.

GRAVITY SEWERS

E37. INSTRUMENTATION AND MONITORING

E37.1 Description

E37.1.1 The work specified in this Section includes furnishing and installing geotechnical instrumentation to monitor ground water levels and potential movements to surface features, utilities, and ground around and above tunnelling operations, and all excavations. The work includes, but is not limited to installing: surface monitoring points, subsurface monitoring points, utility monitoring points, and structure monitoring points. Also included are furnishing monitoring equipment before tunnelling and excavation work.

E37.1.2 The Contractor is responsible for surveying the elevations and locations of the instruments in accordance with the requirements herein. Baseline readings and elevations shall be determined before shaft or tunnel construction begins to establish a baseline, and during and after operations to monitor any movements related to the tunnelling and shaft construction.

E37.2 Materials

E37.2.1 Surface Monitoring Points: Surface monitoring points shall be established by an inscribed marking or approved Surveyor's nail driven flush with the surface in asphalt or concrete paved areas. In landscaped areas, surface monitoring points shall be established by driving a 500-mm length of steel rebar or 50-mm by 50-mm timber stake flush with the ground. Each monitoring point shall have a tag or marking indicating the station and offset from centerline.

E37.2.2 Subsurface Monitoring Point: Install as identified herein. The settlement rod shall be secured to the PVC casing with a 300-mm length of loose cable or chain to prevent the rod from falling more than approximately 300 mm. The casing shall be flush with the surface or recessed, and capped and protected with a traffic rated road box.

E37.2.3 Utility Monitoring Point: Install as identified herein. Do not use drilling techniques. Vacuum excavation of the hole is acceptable. Do not damage the existing utility.

E37.2.4 Building/Structure Monitoring Point: Structural monitoring points shall be established by an inscribed marking or approved prism mounted securely to the structure. Each control point shall have a tag or marking indicating the identification number and offset from centerline.

E37.3 Submittals

E37.3.1 Submittals shall be made in accordance with the requirements identified in E4 and as listed below.

E37.3.2 Submit the following, at least ten (10) Business Days before scheduled installation of instruments:

(a) Instrumentation Installation Schedule: Submit the proposed schedule for installing the instruments.

(b) Description of methods and materials for installing and protecting instruments.

(c) Confirmation that monitoring points will be installed at locations as specified herein, or if deviations are proposed, submit Shop Drawings with locations of proposed monitoring points shown in plan and profile.

E37.3.3 Reports and Records:

(a) The Contractor shall submit all reports of monitoring data to the Contract Administrator within 24 hours.

(b) Within 72 hours following installation of the instruments, submit drawings showing the actual as-built installed location, the instrument identification number, the instrument type, the installation date and time, and the tip elevation and instrument length where

applicable. Include details of installed instruments, accessories and protective measures, including all dimensions and materials used.

(c) Submit surveyed measurements of all instruments for at least fourteen (14) Calendar Days prior to commencing shaft excavation to establish baseline readings.

(d) Submit pre and post construction surveys including photographs, video, field notes, and sketches along the entire alignment. Surveys should concentrate on significant man made features along the alignment including buildings, gutters, sidewalks, driveways, and other structures or improvements.

E37.4 Quality Control

E37.4.1 Settlement surveying shall be performed by a competent individual with previous experience surveying for the detection of surface deformations. Record the initial elevations of movement detection instruments to 0.001 meter.

E37.4.2 Install all monitoring points and instrumentation at locations identified in E37.5.2(a), or as directed by the Contract Administrator.

E37.4.3 Should actual field conditions prevent installation of instruments at any of the locations identified in E37.5.2(a), obtain acceptance from the Contract Administrator for new instrument location and elevation.

E37.4.4 Surveying of instrumentation shall be referenced to the same control points and benchmarks established for setting out the work. Control points shall be tied to benchmarks and other monuments outside of the zone of influence of the excavation.

E37.4.5 Installation of instrumentation shall, at all times, be performed in the presence of the Contract Administrator.

E37.5 Construction Methods

E37.5.1 General Requirements

(a) Instrumentation shall be installed at the locations identified in E37.5.2(a). Instruments shall be installed in accordance with the submitted and reviewed installation schedule.

(b) Record and report depth of utilities found during utility monitoring point installation.

(c) The Contractor shall confirm locations of underground utilities in all areas where holes are to be drilled and instruments installed. Instrument locations shall be modified, as accepted by the Contract Administrator, to avoid interference with the existing utilities. Repair damage to existing utilities resulting from instrument installations at no additional cost to the City.

(d) The Contractor shall provide access and assistance to the Contract Administrator for obtaining supplemental monitoring data, as requested by Contract Administrator.

E37.5.2 Installation of Instruments

(a) Monitoring instrumentation shall be installed in the following locations:

(i) Branch II Aqueduct: Two locations - Install utility monitoring points on the Aqueduct, one on each side of the river at the closest location to the Discharge Chamber and St. Vital Trunk Connection Manhole excavations.

(ii) Surface monitoring points: Four locations – Install two (2) surface monitoring points on Abinojii Mikanah for the two (2) 1350 mm Gravity Sewer installations.

(iii) Subsurface monitoring points: Four locations – Install two (2) surface monitoring points on Abinojii Mikanah for the two (2) 1350 mm Gravity Sewer installations.

(b) Following completion of the work, all instrumentation shall be removed or abandoned according to applicable codes and standards and as described herein, unless otherwise noted.

E37.5.3 Instrument Protection, Maintenance, and Repair

(a) Protect the instruments and surface control points from damage. Damaged installations shall be replaced or repaired prior to continuing excavation, or tunnelling, unless permitted otherwise in writing by the Contract Administrator.

E37.5.4 Response Values

(a) The following response values shall be utilized for monitoring:
  (i) Branch II Aqueduct:
    - Threshold Value: 6 mm
    - Response Value: 12 mm
    - Shutdown Value: 25 mm
  (ii) Subsurface and Surface Monitoring Points:
    - Threshold Value: 12 mm
    - Response Value: 25 mm
    - Shutdown Value: 50 mm

(b) When the instruments indicate movement equal to the Threshold Value, the Contractor shall meet with City to discuss his construction means and methods to determine what changes, if any, shall be made to better control ground movement. Instrument readings shall be required on a daily basis until readings remain unchanged for five (5) consecutive days.

(c) When the instruments indicate movement equal to the Response Value, the Contractor shall actively control ground movement in accordance with the reviewed plan to prevent reaching the Maximum Allowable Value. Instrument readings shall be required on a daily basis until readings remain unchanged for five (5) consecutive days.

(d) When the instruments indicate movement equal to the Shutdown Value, the Contractor shall stop all work immediately, and meet with the Contract Administrator to develop a plan of action before work can be resumed.

E37.5.5 Duration of Monitoring

(a) Settlement monitoring shall commence prior to the commencement of excavation at the Discharge Chamber and St. Vital Trunk Connection Manhole Work, and prior to the tunneling operation of the 1350 mm Gravity Sewer at the respective east and west sites.

(b) Settlement monitoring shall continue for thirty (30) Calendar Days following successful completion of the Work item, or as directed by the Contract Administrator.

E37.5.6 Abandonment of Instruments

(a) Control Points: All surface control points on public property shall remain in place at the completion of the work. Remove all surface control points on private property during the cleanup and restoration work, or as required by the Contract Administrator.

(b) Monitoring Instruments:
  (i) Surface monitoring points shall remain in place unless directed by the Contract Administrator to remove and dispose of the points.
  (ii) Properly abandon all subsurface and utility settlement monitoring point boreholes by grouting drilled holes and casing with cement bentonite grout conforming to the requirements of Contact Grout in E31.
  (iii) Structural monitoring points shall be removed by the Contractor after completion of the Work and as allowed by the Contract Administrator. The sites shall be restored to the conditions existing prior to installation of the structural monitoring points.

E37.6 Measurement and Payment

E37.6.1 Supply, installation and execution of settlement monitoring as specified herein shall be measured on a unit basis for each location and type of instrumentation installed, as listed in Form B: Prices. Payment will be made at the Contract Price for "Instrumentation and Monitoring" for each location and type of instrumentation as listed in Form B: Prices.

E37.6.2 Payment shall include but not be limited to the supply, installation and protection of the instruments, replacement or repair of damaged utilities, performing baseline measurements, ongoing monitoring, provision of electronic monitoring results, submission of data, and abandoning of the instruments.

E37.6.3 Payment for instrumentation and monitoring will be made on the following schedule:

(a) Fifty percent (50%) of the price will be paid following the installation of each instrument and establishment and provision of baseline measurements.

(b) The remaining fifty percent (50%) will be paid upon completion of the monitoring program as specified herein.

E38. DISCHARGE CHAMBER

E38.1 Description

(a) This Specification shall cover the construction of the new reinforced concrete Discharge Chamber as shown on the Drawings.

E38.2 Submissions

E38.2.1 Submit Shop Drawings for the following in accordance with E4.

(a) Construction method statement for working around Critical Water Infrastructure in accordance with E16.

(b) Excavation and shoring drawings shall be sealed by a Professional Engineer, registered in the Province of Manitoba, experienced in the design of shoring systems for the excavation method proposed.

(c) Submit installation procedure a minimum of ten (10) Business Days prior to installation date.

E38.3 Materials

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

E38.3.1 Metal Fabrications

(a) Metal Fabrications shall conform to E22.7(a).

E38.3.2 Concrete

(a) Concrete mix design shall be as indicated in the Construction Notes on the Drawings and in accordance with CW 2160 and E23.4(a).

E38.3.3 Reinforcing Steel

(a) Reinforcing Steel shall conform to CW 2160 and E24.5(a).

E38.3.4 Grout

(a) Grout, if required, shall be Sika Grout 212 or CPD Non Shrink Grout or approved equal in accordance with B7, mixed and applied in accordance with the manufacturer's instructions and of a consistency suitable for the intended application, as accepted by the Contract Administrator.

E38.3.5 Foundation Waterproofing

(a) Foundation waterproofing shall conform to CW 2160.

E38.3.6 Valve Box Sealant

(a) Sealant for the valve box flange shall be a general purpose butyl sealant rated for buried and exterior locations.

E38.3.7 Joint Fillers

(a) Joint Fillers

(i) Joint filler for concrete slab shall be self-leveling, polyurethane sealant to meet requirements of ASTM C920, Type S, Grade P, Class 25, Use T, M, A, O, and I.

(ii) Approved product: Vulkem 45 as manufactured by Tremco, Sikaflex 1C SL, or approved equal in accordance with B7.

(b) Backer rod shall meet requirements of ASTM C1330.

(c) Bond Breaker: pressure sensitive plastic tape, which will not bond to sealants.

(d) Joint Cleaner: xylol, methylethylketone or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

E38.3.8 Concrete Protection

(a) Concrete Protective Liners and Coatings shall conform to E25.4(a).

E38.3.9 Floor Hatches

(a) Floor Hatches: Cover and frame shall be aluminum. Hinges: Type 316 stainless steel. Slam lock with fixed interior handle and removable exterior turn and lift handle with removable gasketed screw plug, factory installed recessed padlock hasp, lift assistance and automatic hold open device: Type A316 stainless steel. All hardware to be Type 316 stainless steel. All hatches exposed to ambient temperatures shall be insulated with 50 mm of concealed polystyrene foam.

(b) Approved Products:

(i) Bilco Type J-AL, or approved equal in accordance with B7.

E38.3.10 Davit Mount Sleeve and Cap

(a) Davit mount sleeve shall be DBI Sala Advanced Flush Floor Mount Sleeve, Model # 8512828, stainless steel construction.

(b) Cap shall be DBI Sala Advanced Heavy Duty Sleeve Cap, Model #8510827, stainless steel construction.

E38.3.11 Access Ladders

(a) Ladder shall be fabricated from FRP, Aluminum, or stainless steel.

(b) Ladder dimensions as noted on the drawings.

E38.3.12 Extendable Ladder Up-Post:

(a) Approved Product: Ladder Up Safety Post LU-3 (stainless steel) by Bilco. Provide one ladder up-post for each surface access ladder.

E38.4 Construction Methods

E38.4.1 Excavation

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

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

E38.4.2 Backfill

(a) Place and compact backfill material as indicated on the Drawings in accordance with CW 2030. Do not place backfill material in a frozen state. Supply heating and

hoarding in accordance with CW 2160 if required to ensure material does not freeze before compaction is complete.

(b) Notify the Contract Administrator at least one (1) full working day in advance of any backfilling operation. No Backfill shall be placed against concrete until accepted by the Contract Administrator and in no case before field cured test cylinders show the concrete strength to be 75% of the specified 28 day strength.

(c) Backfilling of shoring to the spring line of the adjacent Critical Water Infrastructure shall be with Cement-Stabilized Fill.

E38.4.3 Grout

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

E38.4.4 Pipe Penetrations

(a) Seal pipe penetrations with a hydrophilic waterstop, SikaSwell or approved equal in accordance with B7.

E38.5 Measurement and Payment

(a) Construction of the siphon chambers will be measured on a Lump Sum Basis and paid at the Contract Price for "Construction of Discharge Manhole" for each chamber as listed in Form B: Prices.

(b) Payment shall include but not be limited to:

(i) All necessary labour and materials to complete the work as specified herein;
(ii) Supply and installation of reinforcing steel;
(iii) Supply and installation of cast-in-place concrete;
(iv) Supply and installation of grating;
(v) Supply and installation of metal fabrications including ladders, access hatches, etc.;
(vi) Supply and installation plastic fabrications;
(vii) Construction of structural chamber walls (if required);
(viii) Connections to existing overflows;
(ix) Construction of floor slabs; and
(x) Construction of chamber projection to grade.

E39. FLAP GATES ON 600 MM OVERFLOWS

E39.1 Description

(a) This specification covers the supply, installation, and testing of flap gates.

E39.2 Submittals

E39.2.1 Submit Shop Drawings for the following in accordance with E4.

(a) Drawings shall provide dimensions and show sufficient details to determine compliance with the requirements, including the plate thickness used for all components.

(b) Installation, Operation and Maintenance Manual

E39.3 Materials

(a) Frame, flap, arms, hinges: ASTM A240 Grade 316 Stainless Steel

(b) Hinge bushing: ASTM D4020 UHMWPE

(c) Lip seals and gasket: ASTM D2000 EPDM

(d) Bolts and hardware: ASTM F593 Grade 316 Stainless Steel

(e) Flap Gates supplied shall be FONTAINE-AQUANOX Series N, as manufactured by ISE Metal Inc. or approved equal per B7.

E39.4 Installations

(a) Flap (Cover) of the flap gate shall consist of a flat plate reinforced with welded ribs adequate to withstand the maximum design seating head of 6 m without distortion. Minimum material thickness of all members of the flap (cover) shall be 6 mm.

(b) The frame shall be made of structural members or formed plate welded to form a rigid one-piece frame. The frame shall be of the flange back design suitable for mounting on a concrete wall, with provision for an extra wide flange as required. Minimum material thickness of all members of the frame shall be 6 mm.

(c) A resilient lip seal shall be supplied all around the perimeter of the frame opening. The side seals shall be bolted around the frame opening using a longitudinal stainless steel seal retainer.

(d) Hinges shall consist of stainless steel pins, pivoting in UHMWPE bushing generously sized for extra robustness.

(e) Hinge arms shall be made of structural members or formed plates.

(f) The quantity, size and location of anchor bolts shall be as recommended by the manufacturer and shown on Shop Drawings.

(g) Before assembly, frame and all others welded parts shall be completely cleaned by abrasive blast using single-use glass bead or crushed glass, never recycled. All the surfaces of all parts shall be cleaned, in order to remove all contaminants and allow the stainless steel surface to passivate by spontaneously forming a chemically resistant surface when exposed to air. Cleaning only the welds by paste or other chemical means is not an acceptable method to remove all contaminants from the fabrication process and achieve the required level of passivation per ASTM A-380.

E39.5 Field Testing

(a) The Contractor shall coordinate and arrange for a qualified field representative of the flap gate supplier/manufacturer to be present prior to and during field testing. The field representative shall complete required adjustment prior to field testing. If the gate fails the field leakage test, the field representative shall undertake adjustments, replacements or other modifications prior to repeating the test. The sequence shall be repeated until the gate passes the allowable leakage test.

(b) The discharge chamber shall be filled to elevation 230 m for purposes of the leakage. The Contractor shall install an inflatable plug on the 1350 mm overflow to maintain levels within the Discharge Chamber. The test shall be a minimum of one (1) hour in length.

(c) The maximum leakage for each gate is 1.24 litres per minute per meter of seating perimeter.

E39.6 Measurement and Payment

(a) The supply and installation Flap Gates will not be measured for payment. The supply and installation of the Flap Gates, including all accessories, material, labour and equipment required for the installation and leak testing will be considered incidental to the Contract Lump Sum for “Construction of Discharge Chamber”.

E40. ST. VITAL TRUNK SEWER CONNECTION

E40.1 Description

(a) This Specification shall cover connections to the existing interceptor sewer.

E40.2 Submissions

E40.2.1 Submit Shop Drawings for the following in accordance with E4.

(a) Construction method statement for working around Critical Water Infrastructure in accordance with E16.

(b) Excavation and shoring drawings shall be sealed by a Professional Engineer, registered in the Province of Manitoba, experienced in the design of shoring systems for the excavation method proposed.

(c) Submit installation procedure a minimum of ten (10) Business Days prior to installation date.

E40.3 Materials

E40.3.1 Cast-in-Place Concrete and Reinforcing Steel

(a) Cast in place concrete and reinforcing steel shall conform to CW 2161, E23.4(a) and E24.5(a).

E40.3.2 Excavation, shoring and backfill shall confirm to E16 and E17

(a) The shoring system utilized shall be a tight fit shoring system designed to preclude the movement of adjacent soils and destabilization of nearby structures. The steel casing and any shoring installed below the top of the existing interceptor sewer/cast in place collar shall be left in place.

(b) Backfilling of shoring to the spring line of the adjacent Critical Water Infrastructure shall be with Cement-Stabilized Fill.

E40.3.3 Cast in Place Concrete Collar and Connection to Interceptor Sewer

(a) The contractor shall take all necessary efforts to protect the existing interceptor sewer from damage during the course of the work.

(b) Construct the cast in place concrete collar as shown on the Drawings. Any and all voiding or excavation below the top of the existing interceptor sewer shall be backfilled with stabilized fill or concrete.

(c) The Contractor may use 1350 mm ATM C76 Class 5 RCP or 9.5 mm Grade A36 Steel pipe for closure of the new St. Vital Trunk Connection Manhole to the existing 1350 Concrete Interceptor.

E40.4 Opening to the Existing Interceptor Sewer

(a) Modifications to the Emergency Bypass in accordance with E42.

(b) The existing 1350 St. Vital Trunk is monolithic concrete pipe installed in tunnel conditions, and is not expected to have the capacity to carry full soil (prism) load. Record Drawings are provided in Appendix D.

(c) Carefully cut through the existing interceptor sewer as noted on the Drawings. The use of pneumatic breakers is prohibited. Sewers may be saw cut or removed using small hand held jack hammers. Final openings in the existing trunk sewer shall be neatly cut square to the existing pipe.

E40.5 Measurement and Payment

E40.5.1 Connection to the Existing Interceptor Sewer

(a) Connection to the existing interceptor sewer will be measured and paid on a Lump Sum basis at the Contract Lump Sum Price for “Connection to St Vital Trunk” as listed in Form B: Prices.

(b) Payment for the connection to the existing interceptor pipe will include but is not limited to the following:

(i) Locating the existing interceptor sewer;

(ii) Installation of shoring;

(iii) all concrete and reinforcing works;

(iv) manhole materials;

(v) concrete collar and pipe closure piece
(vi) backfilling;
(vii) opening of the existing interceptor sewer;
(viii) modifications to the emergency bypass; and
(ix) any other materials and labour specified herein.

E41. ABINOJII MIKANAH GRAVITY SEWER PIPE INSTALLATION

E41.1 Description

(a) This specification details the supply and installation of the two (2) 1350 mm RCP gravity sewer connection crossings under Abinojii Mikanah as shown on the Drawings.

E41.1.1 Gravity Sewer installation on this Site includes:

(a) West Side of Red River - 1350 mm Reinforced Concrete Pipe Gravity Sewer connection located between the east and west bound lanes along Abinojii Mikanah.

(b) East Side of Red River - 1350 mm Reinforced Concrete Pipe Gravity Sewer connection located between the east and west bound lanes along Abinojii Mikanah.

E41.2 Submittals

E41.2.1 Submit Shop Drawings for the following in accordance with E4.

(a) Excavation and shoring drawings shall be sealed by a Professional Engineer, registered in the Province of Manitoba, experienced in the design of shoring systems for the excavation method proposed.

(b) Trenchless installation methodology, including supporting axial forces demonstrating the proposed reinforced concrete pipe is of suitable strength for installation sealed by a Professional Engineer registered to practice in the Province of Manitoba.

(c) Submit shop drawings for pipe products a minimum of ten (10) Business Days prior to installation date and in accordance with E4. Design submissions as noted herein shall be sealed by a Professional Engineer registered to practice engineering in the Province of Manitoba. Submission to include:

(i) All pipe and joint dimensions.
(ii) Steel reinforcement configuration for reinforced concrete pipe.

E41.2.2 Submit quality control documentation for reinforced concrete pipe in accordance with ASTM C76 and CW 2160. Quality control documents shall include the following:

(a) Mill tests for reinforcing steel.

(b) Concrete test results.

(c) Results from three-edge bearing test(s).

E41.3 Materials

E41.3.1 Reinforced Concrete Jacking Pipe

(a) Reinforced concrete jacking pipe shall conform to CW 2130, ASTM C76 and CSA A257.

(b) Minimum pipe class: Class V (ASTM C76) or 140-D (CSA A257).

(c) Pipe shall be a “C-Wall” design with a minimum wall thickness of 157 mm.

(d) Pipe classes for jacking pipe as shown on the Drawings are for long term design conditions and loading. The Contractor shall verify that the pipe class, strength, reinforcing and joint design are suitable for his proposed installation methods and procedures. Design of any pipe to suit installation methods is the responsibility of the Contractor. Axial load carrying capacity shall be designed in accordance with ASCE 27. Design calculations indicating the axial load carrying capacity of the pipe and anticipated jacking loads shall be submitted with the required shop drawings.

(e) Reinforcement for pipe intended for trenchless installations must take into account the potential for the pipe to rotate during installation. The design of stirrups and circumferential reinforcement must not result in a preferential installation orientation for the pipe unless appropriate controls are put in place, precluding rotation of the pipe during installation.

(f) Pipe installed via jacking shall be supplied complete with external joint bands conforming to CW 2130 and ASTM A36.

(g) Perform a minimum of one (1) three-edge bearing test in accordance with ASTM C76 and C497. Test shall confirm both the service cracking and ultimate load capacity of the pipe. Test shall be performed in the presence of the Contract Administrator. The pipe supplier shall provide a minimum of five (5) Business Days advance notice to the Contract Administrator prior to undertaking the test.

E41.3.2 Cementitious Grout

(a) Cementitious grout shall meet the requirements of CW2160 for flowable cement stabilized fill or approved equal in accordance with B7.

E41.3.3 Concrete Protective Liners in accordance with E25.4(a)

E41.4 Construction

E41.4.1 Shoring

(a) Shoring shall be provided for excavations in accordance with E16 and E17.

(b) Excavation shoring shall be designed to accommodate the installation of the Reinforced Concrete pipe and all fittings.

(c) All shoring systems shall comply with Manitoba Workplace Safety and Health requirements.

E41.4.2 Trenchless Installation

(a) Verification of Utility Elevations:

(i) Prior to construction, the Contractor shall verify at their own cost all buried utility elevations. Verification shall occur in a minimum of fourteen (14) Calendar Days prior to any construction such that any required grade adjustments can be made. Contractor shall arrange for all required utility locations, safety watches and other required notifications. Contractor shall provide a minimum of five (5) Business Days notice to the Contract Administrator of conducting utility exposures.

(b) Selection of excavation equipment for installation of sewers by trenchless methods shall be the responsibility of the Contractor and shall be made based on the basis of expected soil conditions outlined in the Geotechnical Data Report. The Contractor shall make allowances in the choice of equipment to account for reasonable and minor deviations in ground conditions and shall have contingency plans for the removal of boulders and other minor changes in ground conditions. Contractor shall continuously visually monitor trenchless excavations for increases in silt content and soft clay in the excavated material. Notify Contract Administrator if silt contents or soft clay in excavated material increase.

(c) Pressure grouting or accepted alternative methods shall be used to fill voids caused by the installation or if the bored hole diameter is greater than the outside diameter of the pipe by more than 25 mm.

(d) Repair all damage to interior Concrete Protective Liners after completion of the pipe installation.

(e) The Contractor is responsible for plugging all grouting ports with water tight plug and coating with a product compatible with the casing pipe's coating.

(f) In the event that there is a substantial change in the character or nature of the subsurface conditions or that obstructions are encountered, which adversely impact

the Contractor's production or construction procedure, the Contractor shall immediately notify the Contract Administrator.

(i) The notice shall provide details of the change in subsurface soil conditions or obstructions encountered, any proposed construction procedure revision that the Contractor intends to undertake, as well as any other relevant supporting information.

(ii) The Contract Administrator shall review the notice as expeditiously as possible to assess whether the change in conditions and revised construction procedures amount to a Change in Work. In the case of obstructions due to boulders in the silt/till or hardpan strata where that stratum is evident in the test hole logs, no consideration will be made for a Change in Work as boulder obstructions can be reasonably anticipated when working in this stratum. Obstructions such as "random boulders" in the clay strata well above the till interface may be considered as a Change in Work dependent on the level of effort required to facilitate their removal.

(iii) Where the Contract Administrator deems that a Change in Work is necessary, it shall be valued in accordance with the provisions of C7.

E41.4.3 Trenchless Excavation Obstructions

(a) Contingency plans for removal of the obstructions encountered in trenchless excavations must be approved by the Contract Administrator and may consist of but not limited to one of the following.

(i) Drill or excavate a shaft at the location of the obstruction and remove the obstruction.

(ii) Remove the obstruction through the jacking head or core hole following drilling, splitting or breaking the obstruction into smaller components as required.

(iii) Other removal methods.

(b) Where the Contract Administrator deems that the obstruction encountered represents a Change in Work, the Contractor will be compensated from the allowance under the Contract unit price "Change in Contract Conditions" in accordance with C7.4 and the following supplemental requirements:

(i) The first four (4) hours of handling obstructions for each occurrence shall be the responsibility of the Contractor.

(ii) Equipment rates for equipment required in support of the obstruction removal shall be compensated at the MHCA rental rates. Equipment not listed in the MHCA rate schedule shall have their rates established by the Contractor prior to the commencement of Work in accordance with the procedure documented in the MHCA rental guide for establishing equipment rental rates and shall be subject to the approval of the Contract Administrator.

(iii) Standby equipment that cannot reasonably be deployed elsewhere during the duration of the obstruction removal shall be compensated at 50% of its established rate as noted in (b)(ii) above.

(iv) Labour rates and material costs associated with obstruction removal shall be compensated as per C7.4 (c) and C7.4.1 with the provision that any removal and replacement of pavements shall be compensated at the Contract Unit Price for such Work.

E41.4.4 Concrete Pipe Installation

(a) Install Pipe in accordance with CW2130.

E41.4.5 Annulus Grouting

(a) A cementitious grout shall be utilized, designed to completely fill the annulus between the jacking pipe and native rock formation.

E41.4.6 CCTV Inspection

(a) Complete a post installation CCTV inspection of the 1350 mm connection to interceptor in accordance with E18.

E41.5 Measurement and Payment

E41.5.1 Supply and Installation of 1350 mm reinforced concrete pipe

(a) Supply and installation of the 1350 mm reinforced concrete pipe will be paid on a length basis at the Contract Unit Price for "Wastewater Sewers" as listed in Form B: Prices. Length to be paid for will be the total length of 1350 mm pipe supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

(b) Measurement will be made horizontally at grade, above the centreline of the pipe from point of intersection between the 1350 mm reinforced concrete pipe and the inside face of the new Discharge Manhole or existing Trunk sewer and the inside face of the finished siphon chamber.

(c) Payment for the supply and installation of the 1350 mm reinforced concrete pipes will include but is not limited to the following:

(i) Locating the existing interceptor sewer;
(ii) opening of the existing interceptor sewer;
(iii) Installation of shoring (if required);
(iv) trenchless installation of the 1350 mm reinforced concrete pipes;
(v) grouting of the pipe annulus (if required); and
(vi) backfilling; and
(vii) any other materials and labour incidental to completion of the Works.

E42. EMERGENCY BY-PASS STAGING AND FINAL TIE IN

E42.1 Description

(a) The emergency bypass constructed prior to this Tender will remain in place throughout the duration of construction. The bypass is connected directly to the D'Arcy Lift Station, crossing the eastbound Abinojii Mikanah/Fort Garry Bridge, and discharges in the existing downstream siphon chamber. The emergency bypass is shown on the Drawings. Flow control will require modification to facilitate the installation of the 1350 mm Gravity Sewer and St. Vital Trunk Sewer Connection.

(b) This Specification shall cover required modifications to the Emergency Bypass for the installation of the 1350 mm Gravity Sewer and St. Vital Trunk Sewer Connection required to perform the work.

E42.2 Procedures

(a) Flow bypass of the emergency force main bypass will be required during connection of the new Red River siphon crossing to the Abinojii Mikanah trunk sewer on the east side of the Red River.

(b) The temporary force main system is capable of delivering up to 820 lps of flow during wet weather events

(c) During dry weather, the temporary force main system typically will deliver 375 lps, and typically the system pumps all day, with only short periods of inactivity in the early mornings from 3:00 AM to 9:00 AM.

(d) The force main system can only be shut down for brief periods of approximately 6 hours and only during dry weather.

(e) The Contractor shall design the flow control bypass for connections to the downstream trunk by:

(i) Fluming flows through the downstream connection manhole until such a time as the new siphon and trunk sewer are in service. Flume shall consist of a maximum 5.5 m

straight section of smooth wall pipe having a minimum internal diameter of 711.2 mm (28”), or be hydraulically equivalent.

(ii) Extending the temporary force mains with 80 m (x2) of 508 mm (20”) DR 17 HDPE to the new manhole location, complete with an air gap at St. Vital Trunk Sewer Connection located at grade to prevent vacuum in the upstream section of the force main. Force main cutover must be completed one at a time and only during dry weather.

(f) Coordinate temporary bypass work with the Temporary Force main contractor identified in D22.2, including any required valve movements on the temporary system.

(g) Once flow is established in the new Red River siphon crossing, Contractor shall allow five (5) Business Days for testing and commissioning, including efforts in removal and reinstallation of stop logs in each chamber at minimum two (2) times.

(i) The intent of the testing shall be to confirm normal DWF elevations and final configuration of stop logs as determined by the Contract Administrator.

(h) Upon completion, testing and commissioning of the new siphons and WWS trunks, coordinate diversion of temporary bypass pumping systems to the new trunk system with the Contract Administrator a minimum of twenty (20) Working Days prior to expected reinstatement of the gravity sewer system. The delineation of Work for the Final Tie in and reinstatement is as follows:

(i) Temporary Force Main Contractor identified in D22.2

- Replacement/removal of pumps and piping within the D’Arcy Lift Station, with reinstatement of flow into the Discharge Chamber.
- Repairs within the D’Arcy Lift Station, not inclusive of any damage caused during CIPP works of this Contract.
- Removal of external pumps and generators from site.

(ii) Work in this Contract

- Removal of all remaining HDPE piping and appurtenances (valves, fittings etc.) on site.
- Reconstruction of Gate Chambers.
- Abandon the existing St. Vital Trunk from the new St. Vital Trunk Sewer Connection to the Existing Downstream Siphon Chamber in accordance with CW 2130.
- Cut and remove the top 1.2 meters, at minimum, below grade of the Existing Downstream Siphon Chamber and Class 3 Backfill in accordance with CW 2130.
- Restoration.

E42.3 Measurement and Payment

(a) Modifications to the existing Emergency Bypass will be paid for on a Lump Sum basis at the Contract Price for “Modifications to the Existing Emergency Bypass”. Payment will include materials, labour and equipment required in coordinating and implementing the modified Emergency Bypass to facilitate the construction of the St. Vital Trunk Sewer Connection and 1350 mm Gravity Sewer Installation.

(b) Removal and disposal of remaining HDPE pipe and appurtenances will be paid for at a Daily Rate at the Contract Daily Rate for “Emergency Bypass Removal”.

(c) Restorations for Work related Emergency Bypass Removal will be paid in accordance with E50.

(d) Reconstruction of Gate Chambers will be paid on a Unit Price bases at the Contract Unit Price for “Reconstruction of Existing Gate Chambers”.

REHABILITATION AND EXISTING SIPHON CHAMBER MODIFICATION WORKS

E43. EXISTING SIPHON CHAMBER MODIFICATIONS

E43.1 Description

(a) This Specification shall cover the work for modifications to the D'Arcy Lift Station, Fort Garry Trunk Gate Chamber and Glengarry Trunk Gate Chamber to facilitate CIPP lining.

E43.2 Modifications

(a) Chip out, remove and reinstall the existing 900 mm Flap Gate:
  (i) 900 mm Hydro Gate Series 50C Flat Back Seat Heavy Duty Flap Gate. Shop drawing is provided in Appendix D.
  (ii) 900 mm CI Round Flange Round Opening Armtec Type "F" Wall Thimble – Contractor to dispose.

(b) Supply and install new 900 mm Type F cast-iron wall thimble to ASTM A 48 Cast Iron (Class 30) or ASTM A126 Cast Iron (Class B).

(c) Supply and install new mounting bolts in accordance with manufacturer recommendation, Type 316 Stainless Steel.

(d) Remove any remaining concrete on vertical wall to make flush, install dowels, reinforcing steel and place concrete as shown in Drawings to repair hole and make water tight.

(e) Core new 900 mm hole in existing wall as shown on Drawings, and chip existing grout on invert to make room for flap gate and thimble.

(f) Install new concrete curb with round flange wall thimble as shown on Drawings.

(g) Mount existing Flap Gate to wall thimble.

E43.3 Field Testing

(a) The overflow chamber shall be filled to elevation 230 m for purposes of the leakage. The Contractor shall assume the existing sluice gate is not leak tight, and shall install an inflatable plug on the 900 mm outlet to maintain levels within the Discharge Chamber. The test shall be a minimum of one (1) hour in length.

(b) The maximum leakage for the gate is 1.24 litres per minute per meter of seating perimeter.

E43.4 Measurement and Payment

(a) Existing Siphon Chamber Modifications will be measured and paid on a Lump Sum basis at the Contract price for "Existing Siphon Chamber Modifications" as listed in Form B: Prices. Payment for the Work included in this spec section shall include all necessary labour and materials complete the work as specified and shown on the Drawings.

E44. PIPELINE CLEANING

E44.1 Description

(a) This Specification shall cover the cleaning of the pipelines to be rehabilitated under this Contract.

E44.2 General

E44.2.1 Cleaning Objectives and Methods

(a) Cleaning of the host pipe is necessary to ensure the liner obtains a tight fit with the host pipe and is installed in a manner consistent with long term design objectives.

(b) The objective of the cleaning operation is to remove loose and hardened debris from existing pipelines, resulting a clean pipe and uniformly round conduit for installation of the CIPP liner.

(i) The interior surfaces of the pipes to be lined shall be cleaned sufficiently to remove debris, physical obstructions, sedimentation deposits, tuberculation and other corrosion products, biological deposits, and any other substantial accumulations of oil, grease, debris, or other foreign matter larger than 25 mm in diameter.

(ii) Bond of the liner to the interior wall of the host pipe is not required.

(c) The Contractor may employ a combination of high pressure flushing, pigging, mechanical cleaning, or other methods to ensure the host pipes are cleaned sufficiently to meet the stated objectives.

(d) It is anticipated that pipeline cleaning will take a maximum of two days. The Contractor shall identify during the cleaning plan review period if they believe this time is insufficient to complete the desired level of cleaning.

E44.3 Existing Pipelines

(a) Internal pipeline diameters are provided for planning purposes, based on the best available record information. The Contractor is responsible to confirm the inner pipe diameters as necessary prior to undertaking cleaning work:

Asset ID	Pipeline	Wall Thickness/Pipe Class	Internal Diameter
S-MA70020023	1350 mm Concrete Trunk	159 mm	1372 mm

E44.4 Submittals

E44.4.1 Cleaning Plan

(a) The Contractor shall submit a detailed cleaning plan for review by the Contract Administrator. The cleaning plan at a minimum shall include the following:

(i) Proposed method(s) of cleaning

(ii) Tools and equipment required

(iii) Sizes and densities of foam pigs to be used

(iv) Means of debris removal, collection and disposal

(b) The pipeline cleaning plan shall be submitted a minimum of five (5) Business Days prior to undertaking cleaning operations.

(c) No cleaning operations shall be undertaken prior to review and acceptance of the cleaning plan by the Contract Administrator.

E44.5 Equipment

(a) High velocity sewer flushing equipment shall meet the requirements of CW2140.

E44.6 Cleaning Approach

(a) The Contractor shall not deviate from the submitted and accepted cleaning plan without notification to and acceptance by the Contract Administrator.

(b) Retrieval of Cleaning Equipment

(i) The Contractor shall be responsible for the retrieval of any cleaning equipment which becomes stuck within the host pipe, and the repair of any damage to the host pipe caused by the work or the retrieval process.

(c) Disposal of Solid Debris

(i) Where hydrovactoring of sewage and cleaning debris is required, the sewage may be decanted into WWS Chambers on site as approved by the Contract Administrator.

(ii) Solid debris shall be hauled off site as per CW 2140.

E44.7 Measurement and Payment

E44.7.1 Pipeline Cleaning

(a) Pipeline cleaning will be measured and paid on a daily basis with an hourly overtime rate.

(b) Payment for “Pipeline Cleaning” shall include all materials and performance of all work as specified herein, including site access, removal of access hatches, confined entry support, temporary access, flow diversions, performance of all cleaning and gauging work, and disposal of solid debris.

(c) Time measured will be based on on-site availability of the Contractor’s crews, from the time crews are present on site, until cleaning work is complete and the site is secured for the shift, as certified by the Contract Administrator. Delays in cleaning caused by malfunctioning equipment or poor planning on the part of the Contractor will not be considered for payment.

(d) The Daily Cleaning Rate will apply for each day of cleaning activity, up to a maximum of 10 hours. Hourly Overtime Rate will apply for each hour or measurable portion thereof in excess of the Daily Cleaning Rate maximum.

(e) Flushing of pipelines for the purposes of debris removal will be considered incidental to “Pipeline Cleaning” and will not be measured for payment. No additional payment will be made.

E45. LINING INSPECTION

E45.1 Description:

(a) This Specification describes the requirements for obtaining sewer measurements and inspections required to facilitate the specified rehabilitation work.

E45.2 Methods

E45.2.1 Complete CCTV in accordance with E18.

E45.2.2 Confirmation of pipe lengths shall be obtained during cleaning and inspection operations.

E45.2.3 Verification of Existing Sewer Dimensions

(a) Verify pipe diameter(s) prior to liner installation as follows:

(i) Measure the diameter and cross-section of the pipes.

(ii) Use calibrated callipers or other suitable measuring device capable of measuring accurately to +/- 1 mm to confirm cross section geometry at the following clock positions:

- 2:00 to 6:00
- 2:00 to 8:00
- 3:00 to 9:00
- 4:00 to 10:00

(iii) Internal pipeline diameters are provided in E44.3 for planning and design purposes, based on the best available record information.

(b) Verify pipe length(s) to confirm the liner length prior to installation.

(c) Submit host pipe lengths, depths, and dimensions to the Contract Administrator.

(d) Confirm measured pipe dimensions and lengths with the Contract Administrator prior to CIPP liner installation.

(e) The internal diameter of the liner upon completion of the rehabilitation shall be no less than 1050 mm.

E45.2.4 Perform the following inspections in accordance with CW 2145 and/or as outlined herein:

(a) CCTV inspection technology shall be employed as specified below to complete the required inspections.

(b) For all CCTV inspections, the pipes shall be fully dewatered to permit full inspection of the pipeline.

(c) Pre-Lining Inspection:

(i) Perform after sewer cleaning and preparation.

(ii) The Pre-Lining Inspection shall confirm:

- Necessary cleaning and pipe preparation work have been satisfactorily completed.
- That the pipeline is nominally clear of debris and other obstructions.
- That the condition of the pipeline is consistent with the design conditions and the Specifications. The Contractor shall advise the Contract Administrator of any condition that is contrary to the design conditions or assumptions made that may affect either long or short term performance of the liner prior to commencing lining.

(iii) Pre-Lining inspection shall be completed by CCTV.

(iv) Pre-Lining inspection shall be reviewed on site or provided to the Contract Administrator to review. Provide to the Contract Administrator a minimum of one (1) Business Day prior to lining for review and acceptance prior to proceeding with the liner installation.

(v) No coding of the submission will be required.

(d) Post-Lining Inspection:

(i) Perform post-lining inspection immediately following installation of the liner, while flow control measures are in place and before restoring the pipes to active service.

(ii) Intent of the post-lining inspection is to confirm the overall fit and finish of the liner.

(iii) Post-Lining inspection shall be completed by CCTV inspection.

(iv) Preliminary post-lining inspection summary results shall be provided within one (1) Business Day of completion of the inspection to permit review prior to placing the pipes back into service.

- The Contract Administrator will be available to attend the post-lining inspection for review and verification of inspection results prior to preparation of the post-lining report.

(v) Total Performance for the project will not be granted prior to submission and acceptance of the completed post-lining inspection and associated reports.

E45.2.5 Inspection Reports

(a) Pre- and post-lining inspection reports, including all data post processing as required, shall be submitted before acceptance of the Work for Total Performance.

E45.3 Measurement and Payment

E45.3.1 Verification of Sewer Dimensions:

(a) Verification of existing sewer lengths, depths, and dimensions shall be considered incidental to the Work and will not be measured for payment. No separate payment will be made.

E45.3.2 Pipeline Inspections and Inspect Reports in accordance with E18.

E46. SUPPLY AND INSTALLATION OF CIPP LINERS

E46.1 Description

(a) This specification covers the supply and installation of full segment cured-in-place pipe (CIPP) for rehabilitation of the 1350 mm RCP Gravity Overflow.

E46.2 Definitions

(a) Cured-in-place-pipe (CIPP) means trenchless sewer rehabilitation by installing a resin-felt composite structure which when cured will form a continuous-close fit liner within an existing sewer.

(b) Full segment CIPP means CIPP extending from manhole to manhole or manhole to node (wye or tee connection to another sewer).

(c) Non-Reinforced CIPP liners shall be considered any CIPP liner constructed from a non-reinforced felt.

(d) Reinforced CIPP liners shall be considered any CIPP liner constructed from either a glass fibre reinforced felt or a resin-glass fiber composite system.

E46.3 Pre-Approved CIPP Suppliers, Installers, and Materials

(a) The following is a list of sewer lining systems – suppliers, installers and materials that have been pre-approved under the City of Winnipeg "Request for Qualifications for the Supply and Installation of Cured in Pipe (CIPP)" Bid Opportunity No. 253-2006 and Bid Opportunity 403-2007 for City of Winnipeg sewer rehabilitation projects.

Applicant	***Insituform Technologies Limited***	***Capital Commercial Pipe Services***	***Nelson River Construction Inc.***
Contact	Andrew Foster 780-413-0200	Brian Ratchford 905-522-0522	Mike Huard 204-949-8740
Supplier	Insituform Technologies Inc.	Capital Commercial Pipe Services	C.I.P.P. Corporation
Installer	Insituform Technologies Limited	Capital Commercial Pipe Services	Nelson River Construction Inc.
Liner Name	Standard ITL CIPP & Standard ITL CIPP AISC	Capital Lining System (CIPP)	C.I.P.P. Corp Liner

(b) Notwithstanding pre-approval under City of Winnipeg "Request for Qualifications for the Supply and Installation of Cured in Pipe (CIPP)" Bid Opportunity No. 253-2006 and Bid Opportunity 403-2007, Bidders must meet the qualifications identified in B13.

E46.4 Submittals

(a) Installation of CIPP liners shall not commence prior to submission and review of the submissions identified herein by the Contract Administrator.

(b) Provide the Contract Administrator mechanical and other declared properties of their reinforced and non-reinforced CIPP liners a minimum of ten (10) Business Days prior to starting lining operations for the Contract Administrator to complete the liner design.

(c) Submit a liner impregnation protocol a minimum of five (5) Business Days prior to wet of out liners. The liner impregnation protocol shall include the following:

(i) Resin impregnation method.

(ii) Designated location of the wet out facility.

(iii) Documentation that the resin to be used has not exceeded its shelf life as recommended by the manufacturer of the resin.

(iv) Volume and weight of resin to be impregnated into each liner and repair section including the proposed excess allowance for polymerization and migration (typically 7%) into cracks and joints of the host pipe. Resin migration amounts shall be rationalized based on the installation, host pipe material/condition and experience with the proposed product.

(v) Resin calculations shall be provided for each liner.

(vi) Roller gap setting required to provide the final installed CIPP thickness based on the proposed volume of resin.

(d) Submit a liner installation protocol a minimum of ten (10) Business Days prior to installation of CIPP. The liner installation protocol shall include the following:

(i) Installation and curing method complete with proposed equipment.

(ii) Site layout drawing showing the location of all proposed equipment required for installation.

(iii) A full curing protocol, including:

- Curing times (heat up, curing, cool down)
- Inversion and cure pressures (minimum and maximum)
- Recommended adjustments to the curing time based on the heat sink and the inability to reach targeted temperatures for exotherm initiation and sustained cooking temperatures.

(iv) Provide the maximum allowable axial and longitudinal tensile stress for the fabric tube and the arrangement for monitoring pull-in forces during installation if liner insertion is to be by pull-in methods.

(v) Estimated length of time required to reinstate the sewer pipes.

(vi) Additional information may be required by the Contract Administrator for complex installations. This may include site setup details, over the hole wet out procedures, and other information pertinent to the review and evaluation of the Contractors proposed construction methods.

(vii) A common installation procedure may be submitted for the proposed liners. Notwithstanding, any individual liner installation requirements shall be clearly identified in the submission.

(e) Submit a sampling protocol a minimum of five (5) Business Days prior to installation of CIPP. The protocol shall include:

(i) Sampling procedures for plate samples, confined pipe samples, and direct cut samples.

(ii) Sizes for all samples to be obtained.

(iii) Liner repair products and procedures for direct cut samples.

E46.4.1 Submit a styrene management plan in accordance with E46.7.4 a minimum of five (5) Business Days prior to installation CIPP liners requiring styrene management. All styrene management plans shall include sufficient details on:

(a) Regulatory compliance considerations for discharge based on the Contractor's proposed resin selection, curing method, and discharge location for steam condensate or cure water, first flush, etc.

(b) The means, methods, and techniques employed to mitigate styrene levels to within acceptable limits for the site specific application, including:

(i) Resin selection to eliminate or mitigate styrene levels;

(ii) Cure considerations to mitigate excessive styrene volatilization;

(iii) Handling considerations, post cure to mitigate levels discharged to aquatic or other environments that may be deleteriously impacted by excessive styrene levels.

E46.5 Design of CIPP Liners

E46.5.1 Design Objectives

(a) Maximizing the structural enhancement of the sewer by installing a close-fit CIPP.

(b) Maximize the internal diameter of the rehabilitated sewer with as little impact on the hydraulic capacity of the sewer as possible.

(c) Eliminating infiltration and exfiltration.

(d) Preventing root intrusion.

(e) Providing sufficient chemical resistance to prevent further sewer pipe degradation related to the conveyance of sewage.

(f) Minimizing sewer service disruption during rehabilitation.

(g) Minimizing the time required to complete the sewer rehabilitation.

(h) Minimizing disturbance to pavements and boulevards.

(i) Minimizing disruption to vehicular and pedestrian traffic.

(j) Minimizing the impact of construction on commercial, industrial, and institutional facilities.

(k) Select a CIPP product and construction approach for rehabilitation with the intent towards maximizing the achievement of these design objectives.

E46.5.2 General Requirements

(a) Chemical and mechanical properties of the liner based on the waste stream to establish and minimum design life of 50 years.

(b) Size CIPP in accordance with the design objectives to provide a close-fit to the host pipe with no annulus except for the maximum allowable diametric shrinkage due to curing permitted in ASTM D5813.

(c) Long-term values for flexural modulus of elasticity and flexural strength will be considered to be the projected value at 50 years of a continuous application of the design load based on the specific resin and felt composite as established by ASTM D2990 based on an applied stress level of 25% of the yield strength of the liner and approved for use in the pre-qualification process. A minimum test length of 10,000 hrs is required. The Contractor shall provide supporting long term test data conforming to ASTM D2990 for any resin and felt composites not approved for use in the prequalification process.

(d) The Contractor shall provide short term test data on the modulus of elasticity and flexural strength of the in place composite structure conforming to ASTM D790 for any resin and felt composites not approved for use in the prequalification process.

E46.5.3 Minimum Loading Assumptions:

(a) Unless otherwise specified, the groundwater table shall be assumed to be at existing ground surface.

(b) Calculate soil loads based on saturated soil unit weight of 18.85 kN/m^3 (1922 kg/m^3).

(c) Design calculations shall consider both maximum and minimum soil cover scenarios for each liner. The governing load case shall govern the design.

(d) The following live loads shall be included in the design:

(i) The applied soil pressures from an AASHTO HS 20 design truck unless a higher or lower value is indicated in the contract specifications shall be estimated and utilized in the design of the CIPP liner. Applied soil pressures from AASHTO design truck loads shall be estimated in accordance with AASHTO LRFD Bridge Design Specifications (Current Edition).

(e) Unless otherwise specified, applied soil pressures at depth caused by superimposed surface loads shall be calculated using the Boussinesq solution for distribution of stresses from surface point loads.

E46.5.4 Circular CIPP Design – Minimum Design Assumptions

(a) An enhancement factor (K) of 7, assuming a close fit with the host pipe.

(b) Minimum factor of safety (N) of 2 for restrained buckling analysis.

(c) Modulus of soil reaction (E’s) will be assumed to be 4800 kPa unless otherwise specified.

(d) The following minimum values for ovality of the existing sewer shall be used unless otherwise specified or as determined from observation of the maintenance inspection:

(i) Fully deteriorated design – 2%

(e) Design CIPP for fully deteriorated pipe condition in accordance with Appendix X1 of ASTM F1216 and the following minimum design checks:

(i) Determine wall thickness by restrained buckling analysis.

(ii) Check minimum wall thickness requirements.

(f) Applied external loads shall be estimated in accordance with Appendix X1 of ASTM F1216.

E46.5.5 Existing Sewer Design Conditions

(a) CCTV inspection of the 1350 mm trunk sewer was completed in 2011 and is available to the Contractor for review.

E46.6 Materials

E46.6.1 Non-Reinforced CIPP Products

(a) Non-Reinforced CIPP products shall conform to the requirements of ASTM F1216 and D5813.

E46.6.2 Reinforced CIPP Products

(a) Reinforced CIPP products shall conform to the requirements of ASTM F2019 and D5813. Notwithstanding ASTM F2019, the fabric tube may be reinforced with either glass or carbon fibres, as required to achieve the desired short and long term material properties and may be installed via inversion methods.

E46.7 Construction Methods

E46.7.1 Verification of Existing Sewer Dimensions

(a) Internal pipeline diameters are provided in E44.3 for planning and design purposes, based on the best available record information.

(b) Verify dimensions of the pipe to be rehabilitated prior to liner installation, and notify the Contract Administrator immediately of any apparent discrepancies or issues.

E46.7.2 Sewer Cleaning and Preparation Prior to Lining

(a) Complete cleaning and internal host pipe repairs in accordance with E44.

E46.7.3 Installation of CIPP

(a) Unless otherwise specified, install liners by inversion methods in accordance with ASTM F1216.

(b) Carry out workmanship in accordance with ASTM D5813.

(c) Trim ends of CIPP neatly to fit flush with interior vertical face of the chamber and benching, and seal to make watertight.

(d) Fill annular spaces where the CIPP does not make an adequate seal with the host pipe at termination points with a resin-rich mixture compatible with the CIPP.

E46.7.4 Styrene Management

(a) Under no circumstances shall cure water or condensate containing styrene be discharged into a storm sewer or any other direct connection to surficial drainage courses or facilities.

(b) The Contractor shall develop and implement a styrene management plan for each site that could reasonably be impacted by planned or inadvertent discharge of styrene into the land drainage system, based on the site specific conditions for the CIPP installation and boundary conditions at that site.

(c) The Contractor shall submit styrene management plan(s) for each identified site in accordance with E46.4.1.

(d) The Contractor's styrene management approach shall include one of the following methods of control:

(i) Use of styrene free resins;

(ii) Use of on-site treatment systems where hot water curing methods are utilized;

(iii) 100% condensate capture and off-site disposal to the WWS system;

(iv) On-site monitoring to verify no residual styrene is discharged to the environment where UV curing methods are used.

(e) The Contractor shall be responsible to undertake sufficient monitoring to confirm and demonstrate that discharge levels are consistent with the styrene management plan's stated discharge limit objectives. Provide a report on styrene monitoring results upon completion of liner installation.

E46.7.5 Quality Control Records

(a) Maintain the following Quality Control records of the work and provide to the Contract Administrator after completion of the work.

(i) Summary of the resin impregnation process including:

(ii) Volume of resin supplied.

(iii) Excess quantity of resin added during the wet out to account for polymerization and migration into the host pipe.

(iv) Roller gap setting.

(v) Resin catalyst(s) used.

(vi) Time and location of the wet out.

(vii) Means taken to store and transport the resin impregnated CIPP from the wet out facility to the job site.

(b) Means of curing liners.

(c) Continuous log of pressure maintained in the liner during the curing period.

(d) Pulling force used to pull or winch CIPP into place in the host sewer and measured liner elongation.

(e) Continuous log of temperature at boiler in and out and at all thermistors placed between the host pipe and the liner at all manholes during the initial cure, cure, and cool down periods.

(f) The Contractor shall install the CIPP liners complete with a thermal sensing cable (to be left in place) that is capable of continuously monitoring curing temperatures along the entire length of CIPP liner. The cable and recording equipment shall be capable of temperature readings every 450 mm in real time. Curing data logs shall be submitted to the Contract Administrator with the Quality Control records.

E46.7.6 CIPP Samples for Quality Assurance Purposes

(a) The following quality assurance testing will be completed on samples prepared during CIPP liner installation:

(i) short term flexural properties in accordance with ASTM D790;

(ii) wall thickness measurements in accordance with ASTM F1216 and D5813;

(b) The Contractor shall provide the following samples from each CIPP liner:

(i) One (1) confined test sample in accordance with 2.6.6.7.8.

(ii) One (1) plate sample in accordance with 2.6.6.7.9 Plate samples are to be utilized for the following tests for each liner:

- Short term flexural properties (ASTM D790)

(c) The Contract Administrator will coordinate and pay for CIPP sample testing as noted herein.

(d) Where issues are identified with sampling procedures and/or for design reconciliation the Contractor shall, upon the request of the Contract Administrator, cut a sample directly from the installed CIPP liner in accordance with 2.6.6.7.10

(e) The Contractor shall obtain and provide the Contract Administrator with pre and post lining measurements taken in accordance with 2.6.6.7.1.2 of this specification to confirm in-place liner thickness.

(f) The Contract Administrator will review CIPP liner thickness results taken from confined pipe samples. Where confined pipe samples are not obtained, thickness measurements will be obtained from liner measurements or direct cut samples.

(g) All samples shall be labeled as follows:

(i) City of Winnipeg Tender Number

(ii) Date of installation

(iii) Pipe diameter

(h) Test Plate Samples

(i) Test plate samples shall be produced from a full thickness portion of the liner (where possible), shall contain the same resin and hardener ratios and volumes used in the CIPP liner wet-out. Ensure the test plate is clamped as close to the final installation thickness of the CIPP liner as possible.

(ii) For unreinforced liners the minimum dimension of test plate sample shall be 300 mm x 300 mm.

(iii) For reinforced liners the test plate sample shall be sized to accommodate a 32:1 span to depth (liner thickness) ratio. Circumferential reinforcing fibres shall be orientated in the long dimension of the test plate sample. Minimum dimensions for the test sample shall be as follows. Confirm the required test plate size for reinforced liners with the Contract Administrator prior to installation of the CIPP liner.

- Width: 13 times the thickness of the liner
- Length: 35.2 times the thickness of the liner

(iv) Prepare test plate samples on-site from the actual CIPP and cure in the following manner:

- In a clamped mold placed in the downtube or manhole for water-cured liners.

(v) For reinforced liners, the direction of the circumferential reinforcement shall be clearly marked on the sample when prepared and wet-out. Markings that are damaged or obscured during the curing process shall be reapplied to ensure the testing laboratory can cut samples in the correct orientation.

(i) Direct Samples

(i) Where directed, the Contractor shall obtain a sample of the installed CIPP liner from within the host pipe.

(ii) Direct samples of the CIPP liner shall be a minimum of 300mm x 300mm for unreinforced liners.

(iii) For reinforced liners the sample shall be sized to accommodate a 32:1 span to depth (liner thickness) ratio. Circumferential reinforcing fibres shall be orientated in the long dimension of the sample. Minimum dimensions for the test sample shall be as follows. Confirm the required sample size for reinforced liners with the Contract Administrator prior to obtaining the sample.

- Width: 13 times the thickness of the liner
- Length: 35.2 times the thickness of the liner

(iv) Confirm sampling locations with the Contract Administrator prior to work. Direct samples from reinforced liners shall be oriented with the long dimension vertically in the straightest portion of the sewer or as directed by the Contract Administrator.

(v) For repairs up to 25 mm in thickness, grout the area where test sample was taken with a resin-rich repair product such as an epoxy based repair system that is compatible with the liner system and specifically designed for the nature, size and thickness of the patch being repaired to form a smooth watertight patch flush with liner.

- For repairs over 25 mm in thickness, polymer modified cementitious grout compatible with the liner materials may be used.

(vi) The Contractor shall provide photographs of any repairs at direct sampling locations.

E46.7.7 Post Construction Design Review

(a) The Contract Administrator will perform a post-construction design review to confirm that the completed CIPP meets the 50 year design life structural requirements prior to issuance of Total Performance. The design review will utilize the measured values for flexural strength, flexural modulus, and CIPP thickness from the confined pipe sample testing, directly obtained samples, or the reduced strength/modulus values obtained from the test plate testing in circumstances where confined pipe samples are not able to be secured.

(b) CIPP strength values will be further reduced to account for creep based on the creep reduction values recommended in the pre-qualification submissions to assess the suitability of the liner to meet the 50 year design life requirement. The use of full enhancement factors in this analysis will be limited to liners that are confirmed by visual classification to be close-fit liners based on the post-lining sewer inspection.

(c) The Contract Administrator will advise of any discrepancies between the constructed CIPP and the design requirements.

(d) Defects in CIPP liners will be reviewed on a case by case basis by the Contract Administrator. The Contract Administrator will consult with the Contractor and take into account the condition of the host pipe prior to lining, the CIPP installation conditions, and the long term use of the sewer to assess the structural and performance ramifications of the defects.

(e) The Contractor shall:

(i) Perform necessary remedial measures to confirm that a CIPP deemed as structurally deficient will comply with the 50 year design life requirement such as confirmation of actual ovality, determination of a more representative groundwater elevation locally through monitoring, and supplemental strength testing and thickness measurements.

(ii) Repair sections of CIPP removed for supplemental testing by placing a full circumference internal point repair of the same thickness as the full segment liner over and extending 300 millimetres beyond each side of the cut section.

(iii) Install a supplemental CIPP of the required thickness to structurally enhance the installed CIPP if supplemental testing fails to confirm the CIPP will meet the 50 year design life requirement.

(iv) Review remedial action plan with the Contract Administrator prior to implementation.

(v) Perform further testing, monitoring and calculations and install structural enhancements at own cost.

E46.8 Measurement and Payment

E46.8.1 Verification of Existing Sewer and CIPP Dimensions

(a) Verification of existing sewer and CIPP dimensions shall be considered incidental to the Work and will not be measured for payment. No separate payment will be made.

E46.8.2 CIPP Installation

(a) Liner installation will be measured on a length basis and paid for at the Contract Unit Price for “Rehabilitation of the 1350 mm Overflow”. The length to be paid for will be

the total length of CIPP supplied and installed in accordance with this specification, accepted and measured by the Contract Administrator.

(b) Full segment CIPP measurement will be made along the centreline of the pipe from upstream to downstream chamber.

(c) Eighty (80) percent of the payment will be made upon satisfactory completion of the CIPP installation work. The remaining twenty (20) percent of the payment will be made upon confirmation of the CIPP strength, delivery and acceptance of all required submissions, shop drawings, and reports, and rectification of all identified defects.

(d) Where CIPP liners are improperly installed due to negligence on the part of the Contractor, payment for the CIPP liner will be withheld until the identified issues have been rectified.

E46.8.3 Quality Control Records

(a) Preparation of quality control records shall be considered incidental to the CIPP installation and will not be measured for payment. No separate payment shall be made.

E46.8.4 Test Samples

(a) All work and materials required for the preparation, recovery, and repair of CIPP test samples shall be considered incidental to the CIPP installation and will not be measured for payment. No separate payment shall be made.

RESTORATION

E47. TREE PLANTING

E47.1 Description

E47.1.1 This specification covers the supply and installation of nursery-grown trees, shrubs and groundcover plantings in areas indicated on the Drawings, including preparation, digging, transport and planting, and maintenance.

E47.2 Nomenclature

E47.2.1 Nomenclature of specified nursery stock shall conform to the International Code of Nomenclature for Cultivated Plants and shall be in accordance with the approved scientific names given in the latest edition of Standardized Plant Names. The names of varieties not named therein are generally in conformity with the names accepted in the nursery trade.

E47.3 Materials

E47.3.1 General

(a) The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.

E47.3.2 Source Quality Control

(a) All nursery stock supplied shall be nursery grown and of species and sizes as indicated on the Drawings. Nursery stock shall be No. 1 Grade material in accordance with the current edition of The Canadian Nursery and Landscape Association's (CNLA) "Canadian Standards for Nursery Stock".

(b) Any nursery stock dug from native stands, wood lots, orchards, or neglected nurseries, which have not received proper cultural maintenance, shall be designated as "collected plants". Obtain permission of the Contract Administrator to use collected plants.

(c) The Contractor shall notify Contract Administrator of source of plant material at least seven (7) days in advance of shipment.

(d) Acceptance of plant material at source does not prevent rejection of same plant material on site prior to or after planting operations.

(e) Imported plant material must be accompanied with necessary permits and import licenses. Conform to federal and provincial regulations.

E47.3.3 Water

(a) Water shall be potable and free of minerals that may be detrimental to plant growth.

E47.3.4 Trunk Protection and Tree Support

(a) Tree protection shall be a 100 mm x 600 mm long section of plastic weeping tile material.

(b) Tree support stakes shall be 2400 mm long wood tree stake. Stakes shall be uniform in style and colour.

(i) Other products may be used with prior permission in writing from the Contract Administrator.

(c) The guying straps shall be of a material that is non-abrasive to the tree to prevent girdling injury:

(i) Accepted product: Arbor Tie or approved equal

E47.3.5 Root Ball Burlap

(a) Root ball burlap shall be 150 g Hessian burlap.

E47.3.6 Plant Material

(a) All plant material specified for this project shall be containerized and/or ball and burlap nursery stock and hardy to Canadian Plant Hardiness Zone 3a.

(b) Comply with latest edition of The Canadian Nursery and Landscape Association's (CNLA) "Canadian Standards for Nursery Stock".

(c) Nursery stock shall be No. 1 grade trees, shrubs and groundcovers.

(d) All containerized whips and herbaceous plant material shall have a minimum of one full year's growth. Roots shall be healthy, reaching the sides of the containers, and developed such that the root ball can be kept intact during transplanting. Roots shall not encircle each other to the extent of inhibiting plant growth.

(e) Any plants designated as nursery stock but dug from native stands, wood lots, orchards, or neglected nurseries that have not received proper cultural maintenance, shall be designated as "collected stock". Collected stock is not permitted.

(f) Use trees, shrubs and groundcovers with structurally sound, strong fibrous root systems, and free of disease, insects, defects or injuries, including rodent damage, sun scald, frost cracks, abrasions or scars to the bark. Plants must have been root pruned regularly, but not later than one growing season prior to arrival on site.

(g) All parts of the plants shall be moist and show live, green cambium tissue when cut.

(h) At least one (1) plant of each variety supplied shall bear a tag showing both the botanical and common name of the plant.

(i) Additional Plant Material Qualifications:

(i) Imported Plant Material

- Plant material obtained from areas with milder climatic conditions from those of site acceptable only when moved to site prior to the breaking of buds in their original location and heeled-in in a protected area or placed in cold storage until conditions suitable for planting. Obtain Contract Administrator's acceptance to use imported plant material.

(ii) Cold Storage

- Acceptance by the Contract Administrator is required for plant material that has been held in cold storage.

(iii) Container-Grown Stock

- Acceptable if containers large enough for root development. Trees and shrubs must have grown in container for minimum of one growing season but not longer than two. Root system must be able to hold soil when removed from container. Plants that have become root bound are not acceptable. Container stock must have been fertilized with slow releasing fertilizer.

(iv) Balled and Burlapped Plant Material

- Balled and burlapped deciduous trees are to meet the standards of the most recent edition of The Canadian Nursery and Landscape Association's "Canadian Standards for Nursery Stock".

(v) Tree Spade Dug Material

- Obtain acceptance of the Contract Administrator for digging plant material with mechanized digging equipment, hydraulic spade or clam-shell type. Dig root balls to satisfy Landscape Canada (CNTA) standards. Lift root ball from hole, place in wire basket designed for purpose, line with burlap. Tie basket to ball with heavy rope. Take care not to injure trunk of tree with wire basket ties or rope.

(vi) Substitutions

- Substitutions to plant material as indicated on the Plant List in Form B will not be permitted unless written acceptance by the Contract Administrator has been obtained as to type, variety and size prior to award of Contract. Plant substitutions must be of similar species and of equal size to those originally specified.

E47.4 Construction

E47.4.1 Workmanship

(a) The Contractor shall stake out location of trees and shrubs as per the Drawings. Obtain Contract Administrator's acceptance prior to excavating.

(b) The Contractor shall obtain clearances from all utilities, with respect to underground lines located in the areas to be excavated, prior to commencing planting operations.

(c) The Contractor shall coordinate planting operations; keep the site clean and planting holes drained, and immediately remove soil or debris spilled onto pavement.

E47.4.2 Shipment and Pre-Planting Care

(a) Coordinate shipping of plants and excavation of holes to ensure minimum time lapse between digging and planting.

(b) Protect plant material against abrasion, exposure and extreme temperature change during transit. Avoid binding of planting stock with rope or wire, which would damage bark, break branches or destroy natural shape of plant. Give full support to root balls, especially of large trees, during lifting.

(c) Protect foliage and root balls to prevent loss of moisture during transit and storage.

(d) Remove broken and damaged roots with sharp pruning shears making clean cuts.

(e) Keep roots moist and protect from sun and wind. Trees and shrubs shall be planted within 24 hours of delivery to site; water well.

E47.4.3 Planting Time

(a) Plant material noted for spring planting only must be planted in dormant stage.

(b) Plant only under conditions that are conducive to health and physical conditions of plants.

(c) The Contractor shall provide the Contract Administrator with a planting schedule at least two weeks prior to planting operations. Extending planting operations over long period using limited crew will not be accepted.

E47.4.4 Excavations

(a) Trees: excavate to depth such that the root flare is exposed and flush with finished grade, with a surface width of two times the diameter of the root ball. Backfill around trees with planting soil mixture.

(b) Provide drainage for planting holes in heavy soil if natural drainage does not exist. Have method accepted by the Contract Administrator.

(c) Protect the bottoms of excavations against freezing.

(d) Remove water that enters excavations prior to planting. Ensure source of water is not ground water.

E47.4.5 Planting

(a) Loosen bottom of planting hole to depth of 150 to 200 mm. Cover bottom of each excavation with minimum of 150 mm of planting soil mixture.

(b) Plant trees, shrubs and groundcover vertically, with roots placed straight out in hole. Orient plant material to give best appearance in relation to structures, roads and walkways.

(c) Place plant material to depth equal to depth they were originally growing in nursery or in locations collected.

(d) Ball and burlap root balls: once the tree has been set in its final position, burlap on the root ball shall be folded back from the top 1/3 of the root ball. Do not pull burlap or rope from under root ball.

(e) If a wire basket has been used, it shall be cut off from the top 1/3 of the root ball.

(f) All twine shall be removed from the root ball.

(g) With container stock, remove entire container without disturbing root ball.

(h) All non-biodegradable wrappings must be removed.

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

(j) Excavate 200 mm depth an additional 600 mm beyond planting pits around the perimeter of all tree planting pits, and fill with planting soil mixture.

(k) Construct 75 mm deep saucers around the outer edge of planting pits to assist with maintenance watering.

(l) Tree spade excavated materials:

  (i) Tree spade planting shall be permitted only by acceptance of the Contract Administrator.

  (ii) Dig tree pit with same mechanical equipment as used to dig plant material. Ensure hole dug is upright as possible. Place in hole a mixture of 40 L of planting soil and fertilizer mixed with water to soupy consistency. This will be forced up sides of ball as root ball is placed in hole.

  (iii) Loosen bottom of planting hole to depth of 150 to 200 mm. Cover bottom of each excavation with minimum 150 mm topsoil mixture.

E47.4.6 Pruning

(a) Only prune trees, shrubs and groundcovers to remove broken stems. Postpone pruning of those trees where heavy bleeding may occur, until in full leaf. Employ clean sharp tools and make cuts in accordance with the “ANSI A300 (Part 1)-2001 Pruning standards entitled. “tree Care Operations – Tree, Shrub and Other woody Plant Maintenance – Standard Practices (Pruning)” (revision and re-designation of ANSI A300-1995) (includes supplements) or most recent versions as available and in accordance with “Best Management Practices: Tree Pruning” (2002), which is a companion publication to the ANSI A300, or more recent version as available”.

E47.4.7 Trunk Protection and Tree Support

(a) Slice open the plastic weeping tile material and place it around the base of each tree trunk.

(b) Place tree supports as indicated on Landscape Detail Drawings.

(c) The guying straps shall be attached in accordance with the Landscape Detail Drawings. Where wire is used, ensure ends are twisted tight, protruding ends are unacceptable.

E47.4.8 Wood Chip Mulch

(a) All planting beds shall be covered with a 75 mm depth of wood chip mulch to the limits shown on the planting details.

(b) Wood chip mulch shall extend under all tree limbs, but shall not be installed within 150 mm of the tree trunk.

(c) The saucers of all trees not planted in beds shall be covered with a 75 mm depth of wood chip mulch.

E47.4.9 Maintenance Period

(a) Following acceptance of tree and shrub plantings by the Contract Administrator, the Contractor shall be responsible for the maintenance of the trees for a period of one (1) year from the date of Total Performance. Any areas planted after September 15th, the maintenance period will commence on May 15th of the following year or such date as mutually agreed upon by all parties.

E47.4.10 Maintenance

(a) Watering

(i) Plant material shall be watered once a week for first four weeks following installation, and once every second week, thereafter.

(ii) Watering must be done slowly to ensure that water does not run away from the root zone and so the top 300 mm of the soil around the root system of the tree are well saturated.

(iii) Use a low-pressure open flow nozzle and hose (turf boulevards and parks).

(iv) The water stream must not gouge out a hole in the soil or mulch.

(v) Ensure adequate moisture in root zone at freeze-up.

(b) Weeding

(i) Keep mulched shrub beds and tree saucers weed-free by manually removing weeds during the maintenance period.

(c) Insects and Diseases

(i) Spray plants to combat pests and diseases. Use organic chemical insecticides approved by Agriculture Canada.

(d) Adjustments

(i) Make adjustments requested by the Contract Administrator, including straightening trees, tightening guy wires and removing tree stakes.

E47.4.11 Warranty

(a) The Contractor shall, at their expense, warrant the Work against any and all defects or deficiencies resulting from insect infestation, disease and mechanical damage due to improper handling, installation or maintenance, for a period of one (1) year from the date of the Total Performance. Nursery stock damaged by vandalism or reasons beyond the control of the Contractor shall be replaced by the client.

(b) End-of-Warranty inspection will be conducted by the Contract Administrator.

(c) The Contract Administrator reserves the right to request material replacement or extend the Contractor's Maintenance responsibilities for an additional one (1) year if at

the end of the Warranty Period, leaf development and growth are not sufficient to ensure future survival of the plant material.

E47.5 Measurement and Payment

E47.5.1 Trees

(a) Tree Planting will be considered incidental to the Work, no additional measurement or payment will be made.

E48. PLANTING SOILS

E48.1 General

E48.1.1 This specification shall amend and supplement City of Winnipeg Standard Construction Specification CW 3540-R3 “Topsoil and Finish Grading for Establishment of Turf Areas”, and shall cover supply, preparation and placement of planting soil.

E48.1.2 Referenced Standard Construction Specifications

(a) CW 3540 - Topsoil and Finish Grading for Establishment of Turf Areas.

E48.2 Quality Control

E48.2.1 Testing and Samples:

(a) Submit to the Contract Administrator analyses of soil base to be used in creating growing medium, obtained for at least three separate samples taken from each area of the site. The analysis shall be carried out by a qualified soil testing laboratory and shall include the percentage of organic material by weight, as well as recommendations for fertilizers and/or other soil ameliorants.

(b) Soil testing shall determine N, P, K, Na, Cl, Ca, Mg, organic matter, C.E.C., pH, bulk density and C/N ratio.

(c) Deliver and store fertilizer in waterproof bags showing weight, analysis and name of manufacturer.

E48.3 Materials

E48.3.1 The Contractor shall be responsible for the supply, safe storage and handling of all materials set forth in this Specification. All materials supplied under this Specification shall be subject to inspection and acceptance by the Contract Administrator.

E48.3.2 Imported topsoil and fertilizer shall conform to CW 3540.

E48.3.3 Peatmoss shall be derived from partially decomposed species of Sphagnum Mosses, elastic and homogenous, brown in colour; free of decomposed colloidal residue, wood, sulphur and iron or other deleterious material which could affect healthy plant growth; containing a minimum 60% organic matter by weight, and moisture content not exceeding 15%. Shredded particles may not exceed 5 mm in size. Minimum pH value of peat, 4.5; maximum, 7.0.

E48.3.4 Sand shall be medium to coarse textured silica sand to CSA A82.56-M1976, well washed and free of impurities, chemical or organic matter.

E48.3.5 Bonemeal shall be raw bonemeal, finely ground with a minimum analysis of 3% nitrogen and 20% phosphoric acid.

E48.3.6 Fertilizer: chemical fertilizers shall have N-P-K compositions as recommended by an agricultural soil testing laboratory accepted by the Contract Administrator, provided for horticultural trees and shrubs with planting soil.

E48.4 Construction

E48.4.1 For planting trees and shrubs the planting soil shall consist of a screened clay textured or loam textured dark soil, a fertile, friable material (neither of heavy clay nor of a very light

sandy composition) containing by volume, a minimum of four (4%) percent for clay loams and two (2%) percent for sandy loams to a maximum twenty-five (25%) percent organic matter (peat, rotted manure or composted material) and capable of sustaining vigorous plant growth. The pH shall range from 6.0 to 8.0.

E48.5 Measurement and Payment

(a) Supply and placement of planting soils will be considered incidental to the Work, no additional measurement or payment will be made.

E49. TEMPORARY SURFACE RESTORATION

E49.1 General

(a) This specification applies to temporary surface restoration Work.

E49.2 Construction Methods

(a) Backfill under Temporary Surface Restoration

(i) Backfill and level boulevards and grassed areas to match existing surface elevations.

(ii) Use Class 2 backfill in excavation under temporary street pavement and sidewalk where Class 3 backfill cannot be jetted and flooded due to cold weather.

(iii) Class 2 backfill may be compacted in 600 mm lifts where backhoe operated pneumatic plate compactors are used.

(iv) Jet and flood Class 2, Class 3 and Class 5 backfilled excavations in spring when ground is not frozen prior to permanent restoration.

(b) Temporary Surface Restoration

(i) Cap excavations in concrete pavement with a 100 mm layer of concrete for “Temporary Restoration of Utility Pavement Cuts” as specified in CW 3310.

(ii) Cap excavations in sidewalk pavement with a 50 mm layer of concrete for “Temporary Restoration of Utility Pavement Cuts” as specified in CW 3310.

(iii) Insulate temporary concrete as required during 48 hour curing period.

(iv) Where curb has been removed as part of the pavement cut pour temporary curb using “Concrete for Temporary Restoration of Utility Pavement Cuts” as specified in CW 3310.

(v) Remove all temporary pavements prior to permanent restorations.

(c) Maintenance

(i) The Contractor shall monitor and maintain temporarily restored surfaces as required until permanent restoration is complete.

(ii) If, in the opinion of the Contract Administrator, temporarily restored surfaces are not being adequately maintained or were not properly constructed and pose a danger to the public, maintenance or reconstruction will be done by the City forces with no advance notification the Contractor.

(iii) All costs associated with the maintenance or reconstruction of temporary pavement incurred by the City shall be deducted from future payments to the Contractor.

E49.3 Measurement and Payment

(a) No extra payment will be made for the installation of Class 2 backfill under temporary street pavement and sidewalk.

(b) No measurement or payment will be made for the temporary restorations of boulevards and grassed areas.

(c) No measurement or payment will be made for the removal of temporary pavement prior to permanent restoration.

E50. PERMANENT RESTORATION

E50.1 Description

(a) This specification identifies the requirements for permanent surface restorations.

(b) The specification amends the Surface Restorations defined in CW 2130 and places the cost of permanent surface restorations upon the particular Work item being undertaken.

E50.2 General

(a) The Contractor will follow the City's Street By-law No. 1481/77 and Street Cuts Manual (2024) for all pavement restoration unless otherwise shown on the drawing or specifications or as directed by the Contract Administrator. The Contractor or their subcontractor shall hold a Restoration Contractor's License issued under the Streets By-law in order to restore pavement cuts in accordance with the City of Winnipeg Street Cuts Manual.

(b) The Street Classification and Surface Type within the project work area are classified as follows:

Street Name	Segment	Priority	Pavement Type	General Condition
D'Arcy Drive	Agassiz Drive to End	P3	Asphalt Over Concrete	Poor
Agassiz Drive	Glengarry Drive to End	P3	Concrete	Fair
Thatcher Drive	Glengarry Drive to End	P3	Asphalt Over Concrete	Good
Abinojii Mikanah	Pembina Highway NB/ Abinojii Mikanah EB to Fort Garry Bridge	P1	Asphalt Over Concrete	Good
Abinojii Mikanah	Fort Garry Bridge to River Road	P1	Asphalt Over Concrete	Fair
River Road	River Road to Abinojii Mikanah	P1	Asphalt Over Concrete	Fair
Note: Values obtained from City of Winnipeg Street Conditions Map available at: https://winnipeg.ca/publicworks/maps/streetconditions.asp Conditions reported at the time of posting may not reflect existing conditions.				

(c) All street segments within the work area impacted by the Work as determined by the Contract Administrator shall be maintained and restored with the following additional requirements.

(i) Review and record the condition of each street segment with the Contract Administrator and a City Representative from Public Works prior to the initiation of Work.

(ii) Review and record the condition of each street segment with the Contract Administrator and a City Representative from Public Works prior to surface restoration. The surface restoration required for each street segment will be agreed upon at this review meeting.

(iii) Pavement Restoration Guidelines can be found in the City of Winnipeg Street Cuts Manual and are summarized below.

Asphalt and Asphalt over Concrete:

Rated Pavement Condition of Segment	**Regional Streets**	**Non-Regional Streets**
	Action Required	**Action Required**
New	Grind and repave full lane width, and length of excavation or project *(see Note A-3 and Pavement Restoration Requirements for Series of Cuts)*	Grind and repave full lane width, and length of excavation or project *(see Note A-3 and Pavement Restoration Requirements for Series of Cuts)*
Good		
Fair		Decision after inspection by Public Works Department *(see Notes A-2 and A-3)*
Poor	Decision after inspection by Public Works Department *(see Notes A-2 and A-3)*	Isolated repairs accepted

Portland Cement Concrete:

<table>
<tr><td rowspan="2">Rated Pavement Condition of Segment</td><td>Regional Streets</td><td>Non-Regional Streets</td></tr>
<tr><td>Action Required</td><td>Action Required</td></tr>
<tr><td>New</td><td rowspan="2">Full panel repair</td><td rowspan="2">Full panel repair</td></tr>
<tr><td>Good</td></tr>
<tr><td>Fair</td><td rowspan="2">Decision after inspection by Public Works Department
(see Note B-2)</td><td>Decision after inspection by Public Works Department
(see Note B-2)</td></tr>
<tr><td>Poor</td><td>Isolated repairs accepted</td></tr>
</table>

E50.3 Methods

(a) The Contractor shall permanently restore all existing surface areas disturbed by construction activities including but not limited to areas disturbed by; construction equipment, placement of equipment trailers and where construction materials were stockpiled, shall be restored as follows:

(i) Full depth partial slab patches in accordance with CW 3230.

(ii) Boulevards, ditches and grassed areas - sodding using imported topsoil in accordance with CW 3510. The Contractor shall restore all areas disturbed during construction to existing condition or better, using topsoil and sod at its own cost.

(iii) Asphalt surfaces – match existing base course and asphalt thickness or a minimum of 150 mm of base course and 75 mm of Type 1A Asphaltic Concrete, whichever is greater, in accordance with CW 3410.

(iv) Restore AT Paths as shown on drawings and in accordance with CW3410.

(v) Miscellaneous concrete slabs, including sidewalk - in accordance with CW 3235

(vi) Interlocking stones – in accordance with CW 3330.

(vii) Concrete curb and gutter – in accordance with CW 3240.

(viii) Trees - requiring replacement due to construction activities (as directed by the Contract Administrator) shall be installed in accordance with CW 3510. The Contractor will not be reimbursed under a separate pay item for replacing trees damaged by construction activities. The work will be considered incidental to the Work.

E50.4 Measurement and Payment

(a) Permanent Restoration will be considered incidental to the Work, no additional measurement or payment will be made.

(b) Reconstruction of the East Side Laydown Area Multiuse Pathway will be paid for on a Lump Sum basis at the Contract Lump Sum Price for “East Side Laydown Area – Reconstruction of Multiuse Pathway” as listed in Form B: Prices. Payment for “East Side Laydown Area – Reconstruction of Multiuse Pathway” shall include geotextile, sub-base, base course and asphalt pavement, and all associated materials and labour to complete the work. Payment for restoration of AT Paths at other locations damaged due to construction activities will be considered incidental to the Work.

(c) Permanent Restoration for Work related to the Emergency Bypass Removal will be paid for on a Unit Price basis in accordance with the unit prices listed on Form B:Prices – Provisional Items.

(d) Permanent Restoration for pavement repairs related to provisional items not identified on the Drawings will be measured on a unit price basis and payment will be made in accordance with the unit prices listed on Form B: Prices.