



THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 645-2013

**REPLACEMENT OF VALVE CHAMBER AND ASSOCIATED WORKS AT ELDRIDGE
AVENUE AND HANEY STREET**

TABLE OF CONTENTS

PART A - BID SUBMISSION

Form A: Bid	1
Form B: Prices	4
Form G1: Bid Bond and Agreement to Bond	7
Form G2: Irrevocable Standby Letter of Credit and Undertaking	9

PART B - BIDDING PROCEDURES

B1. Contract Title	1
B2. Submission Deadline	1
B3. Site Investigation	1
B4. Enquiries	1
B5. Confidentiality	2
B6. Addenda	2
B7. Substitutes	2
B8. Bid Components	3
B9. Bid	4
B10. Prices	4
B11. Qualification	5
B12. Bid Security	5
B13. Opening of Bids and Release of Information	6
B14. Irrevocable Bid	7
B15. Withdrawal of Bids	7
B16. Evaluation of Bids	7
B17. Award of Contract	8

PART C - GENERAL CONDITIONS

C0. General Conditions	1
------------------------	---

PART D - SUPPLEMENTAL CONDITIONS

General

D1. General Conditions	1
D2. Scope of Work	1
D3. Definitions	1
D4. Contract Administrator	2
D5. Contractor's Supervisor	2
D6. Ownership of Information, Confidentiality and Non Disclosure	2
D7. Notices	2
D8. Furnishing of Documents	3

Submissions

D9. Authority to Carry on Business	3
D10. Safe Work Plan	3
D11. Insurance	3
D12. Performance Security	4
D13. Subcontractor List	4
D14. Equipment List	4
D15. Detailed Work Schedule	4

Schedule of Work

D16. Commencement	5
D17. Schedule Restrictions	6
D18. Critical Stages	6
D19. Substantial Performance	7
D20. Total Performance	7
D21. Liquidated Damages	7

Control of Work

D22. Job Meetings	8
D23. Prime Contractor – The Workplace Safety and Health Act (Manitoba)	8
D24. The Workplace Safety and Health Act (Manitoba) – Qualifications	8

Measurement and Payment

D25. Payment	8
--------------	---

Warranty

D26. Warranty	8
Form H1: Performance Bond	9
Form H2: Irrevocable Standby Letter of Credit	11
Form J: Subcontractor List	12
Form K: Equipment	13

PART E - SPECIFICATIONS

General

E1. Applicable Specifications and Drawings	1
E2. Soils Investigation Report	1

General Requirements

E3. Office Facilities	1
E4. Shop Drawings	2
E5. Expedited Shop Drawings	4
E6. Environmental Protection	4
E7. Protection of Existing Trees	6
E8. Traffic Management	6
E9. Operating Constraints for Work in Close Proximity to Feeder mains	7
E10. Excavation, Demolition and Backfill	9
E11. Asphalt Surface Treatment	10
E12. Temporary Thrust bracing	12
E13. Supply and Delivery of Prestressed Concrete Pipe and Appurtenances	12
E14. Supply and Delivery of Large diameter PolyVinylchloride Pipe	16
E15. Supply and Installation of Feeder mains	17
E16. Butterfly Valves	24
E17. Manual Valve Actuators	30
E18. Chamber piping	32
E19. Construction of Valve Chamber	35
E20. Chamber Drain	37
E21. Metal fabrications	37
E22. Cast-in-Place Concrete	39
E23. Reinforcing Steel	40

PART F - SECURITY CLEARANCE

F1. Security Clearance	1
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APPENDICES

Appendix A Geotechnical Technical Memo - Site Investigation	
Appendix B Geotechnical Technical Memo - Excavation Recommendations	
Appendix C Existing Site and Chamber Photos	

PART B - BIDDING PROCEDURES

B1. CONTRACT TITLE

B1.1 REPLACEMENT OF VALVE CHAMBER AND ASSOCIATED WORKS AT ELDRIDGE AVENUE AND HANEY STREET

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, August 16, 2013.

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

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

B3. SITE INVESTIGATION

B3.1 Further to C3.1, the Contract Administrator or an authorized representative will be available at the Site from 9:00 A.M. to 11:00 A.M. on August 7, 2013 to provide Bidders access to the Site.

B3.2 The Bidder shall not be entitled to rely on any information or interpretation received at the Site investigation unless that information or interpretation is the Bidder's direct observation, or is provided by the Contract Administrator in writing.

B3.3 Although attendance at the Site Investigations is not mandatory, the City strongly suggests that Proponents attend.

B3.4 The Bidder is advised that the valve chambers are Confined Entry locations. Persons wishing to enter the chambers will be required to supply all necessary personal protective safety equipment, including body harness, hard hats, and safety boots, as well as personal lighting required to view the Site. The City of Winnipeg will provide a retrieval hoist, surface lighting, and gas detector. Personnel attending the Site shall be properly trained in Confined Space entry in accordance with Manitoba legislation and their individual company policy.

B4. ENQUIRIES

B4.1 All enquiries shall be directed to the Contract Administrator identified in D4.1.

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

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

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

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

B5. 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 Bid Opportunity 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 Bid Opportunity, 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.
- B6.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/bidopp.asp>
- B6.2.2 The Bidder is responsible for ensuring that he/she has received all addenda and is advised to check the Materials Management Division website for addenda regularly and shortly before the Submission Deadline, as may be amended by addendum.
- B6.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B7. SUBSTITUTES

- B7.1 The Work is based on the Plant, Materials and methods specified in the Bid Opportunity.
- 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 his/her sole discretion grant approval for the use of a substitute as an "approved equal" or as an "approved alternative", or may refuse to grant approval of the substitute.

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

B7.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he/she wishes to inform.

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 his/her Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B16.

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.

B7.10 Notwithstanding B7.2 to B7.9, and in accordance with B8.6 deviations inconsistent with the Bid Opportunity document shall be evaluated in accordance with B16.1(a).

B8. BID COMPONENTS

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

- (a) Form A: Bid;
- (b) Form B: Prices;
- (c) Bid Security
 - (i) Form G1: Bid Bond and Agreement to Bond, or
Form G2: Irrevocable Standby Letter of Credit and Undertaking, or
a certified cheque or draft;

B8.2 Further to B8.1, the Bidder should include the written correspondence from the Contract Administrator approving a substitute in accordance with B7.

B8.3 All components of the Bid shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely, to constitute a responsive Bid.

B8.4 The Bid shall be submitted enclosed and sealed in an envelope clearly marked with the Bid Opportunity number and the Bidder's name and address.

B8.4.1 Samples or other components of the Bid which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder's Bid.

B8.5 Bidders are advised not to include any information/literature except as requested in accordance with B8.1.

B8.6 Bidders are advised that inclusion of terms and conditions inconsistent with the Bid Opportunity document, including the General Conditions, will be evaluated in accordance with B16.1(a).

B8.7 Bids submitted by facsimile transmission (fax) or internet electronic mail (e-mail) will not be accepted.

B8.8 Bids shall be submitted to:

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

B9. BID

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

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

- (a) if the Bidder is a sole proprietor carrying on business in his/her own name, his/her name shall be inserted;
- (b) if the Bidder is a partnership, the full name of the partnership shall be inserted;
- (c) if the Bidder is a corporation, the full name of the corporation shall be inserted;
- (d) if the Bidder is carrying on business under a name other than his/her own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.

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

B9.4 Paragraph 12 of Form A: Bid shall be signed in accordance with the following requirements:

- (a) if the Bidder is a sole proprietor carrying on business in his/her own name, it shall be signed by the Bidder;
- (b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;
- (c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers and the corporate seal, if the corporation has one, should be affixed;
- (d) if the Bidder is carrying on business under a name other than his/her own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.

B9.4.1 The name and official capacity of all individuals signing Form A: Bid should be printed 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).

B11. QUALIFICATION

B11.1 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.

B11.2 The Bidder and any proposed Subcontractor (for the portion of the Work proposed to be subcontracted to them) shall:

- (a) be responsible and not be suspended, debarred or in default of any obligations to the City. A list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/debar.stm>

B11.3 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);

B11.4 Further to B11.3(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) a valid COR certification number 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
- (b) a report or letter to that effect from an independent reviewer acceptable to the City. (A list of acceptable reviewers and the review template are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/>

B11.5 The Bidder shall submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B11.6 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

B12. BID SECURITY

B12.1 The Bidder shall provide bid security in the form of:

- (a) a bid bond, in the amount of at least ten percent (10%) of the Total Bid Price, and agreement to bond of a company registered to conduct the business of a surety in Manitoba, in the form included in the Bid Submission (Form G1: Bid Bond and Agreement to Bond); or
- (b) an irrevocable standby letter of credit, in the amount of at least ten percent (10%) of the Total Bid Price, and undertaking issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form included in the Bid Submission (Form G2: Irrevocable Standby Letter of Credit and Undertaking); or
- (c) a certified cheque or draft payable to "The City of Winnipeg", in the amount of at least fifty percent (50%) of the Total Bid Price, drawn on a bank or other financial institution registered to conduct business in Manitoba.

B12.1.1 If the Bidder submits alternative bids, the bid security shall be in the amount of the specified percentage of the highest Total Bid Price submitted.

B12.1.2 All signatures on bid securities shall be original.

B12.1.3 The Bidder shall sign the Bid Bond.

B12.1.4 The Surety shall sign and affix its corporate seal on the Bid Bond and the Agreement to Bond.

B12.2 The bid security of the successful Bidder and the next two lowest evaluated responsive and responsible Bidders will be released by the City when a Contract for the Work has been duly executed by the successful Bidder and the performance security furnished as provided herein. The bid securities of all other Bidders will be released when a Contract is awarded.

B12.2.1 Where the bid security provided by the successful Bidder is in the form of a certified cheque or draft pursuant to B12.1(c), it will be deposited and retained by the City as the performance security and no further submission is required.

B12.2.2 The City will not pay any interest on certified cheques or drafts furnished as bid security or subsequently retained as performance security.

B12.3 The bid securities of all Bidders will be released by the City as soon as practicable following notification by the Contract Administrator to the Bidders that no award of Contract will be made pursuant to the Bid Opportunity.

B13. OPENING OF BIDS AND RELEASE OF INFORMATION

B13.1 Bids will be opened publicly, after the Submission Deadline has elapsed, in the office of the Corporate Finance Department, Materials Management Division, or in such other office as may be designated by the Manager of Materials.

B13.1.1 Bidders or their representatives may attend.

B13.2 Following the Submission Deadline, the names of the Bidders and their Total Bid Prices (unevaluated, and pending review and verification of conformance with requirements) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/default.stm>

B13.3 After award of Contract, the name(s) of the successful Bidder(s) and the Contract amount(s) will be available on the Closed Bid Opportunities (or Public/Posted Opening & Award Results) page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/default.stm>

B13.4 The Bidder is advised that any information contained in any Bid may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

B14. IRREVOCABLE BID

- B14.1 The Bid(s) submitted by the Bidder shall be irrevocable for the time period specified in Paragraph 11 of Form A: Bid.
- B14.2 The acceptance by the City of any Bid shall not release the Bids of the next two lowest evaluated responsive Bidders and these Bidders shall be bound by their Bids on such Work until a Contract for the Work has been duly executed and the performance security furnished as herein provided, but any Bid shall be deemed to have lapsed unless accepted within the time period specified in Paragraph 11 of Form A: Bid.

B15. WITHDRAWAL OF BIDS

- B15.1 A Bidder may withdraw his/her Bid without penalty by giving written notice to the Manager of Materials at any time prior to the Submission Deadline.
- B15.1.1 Notwithstanding C23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.
- B15.1.2 The City will assume that any one of the contact persons named in Paragraph 3 of Form A: Bid or the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid, and only such person, has authority to give notice of withdrawal.
- B15.1.3 If a Bidder gives notice of withdrawal prior to the Submission Deadline, the Manager of Materials will:
- (a) retain the Bid until after the Submission Deadline has elapsed;
 - (b) open the Bid to identify the contact person named in Paragraph 3 of Form A: Bid and the Bidder's authorized representatives named in Paragraph 12 of Form A: Bid; and
 - (c) if the notice has been given by any one of the persons specified in B15.1.3(b), declare the Bid withdrawn.
- B15.2 A Bidder who withdraws his/her Bid after the Submission Deadline but before his/her Bid has been released or has lapsed as provided for in B14.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law, including the right to retain the Bidder's bid security.

B16. EVALUATION OF BIDS

- B16.1 Award of the Contract shall be based on the following bid evaluation criteria:
- (a) compliance by the Bidder with the requirements of the Bid Opportunity, or acceptable deviation there from (pass/fail);
 - (b) qualifications of the Bidder and the Subcontractors, if any, pursuant to B11 (pass/fail);
 - (c) Total Bid Price;
 - (d) economic analysis of any approved alternative pursuant to B7.
- B16.2 Further to B16.1(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.
- B16.3 Further to B16.1(b), the Award Authority shall reject any Bid submitted by a Bidder who does not demonstrate, in his/her Bid or in other information required to be submitted, that he/she is responsible and qualified.
- B16.4 Further to B16.1(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.

B16.4.1 Further to B16.1(a), in the event that a unit price is not provided on Form B: Prices, the City will determine the unit price by dividing the Amount (extended price) by the approximate quantity, for the purposes of evaluation and payment.

B17. AWARD OF CONTRACT

B17.1 The City will give notice of the award of the Contract or will give notice that no award will be made.

B17.2 The City will have no obligation to award a Contract to a Bidder, even though one or all of the Bidders are determined to be responsible and qualified, and the Bids are determined to be responsive.

B17.2.1 Without limiting the generality of B17.2, the City will have no obligation to award a Contract where:

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

B17.3 Where an award of Contract is made by the City, the award shall be made to the responsible and qualified Bidder submitting the lowest evaluated responsive Bid, in accordance with B16.

B17.3.1 Following the award of Contract, a Bidder will be provided with information related to the evaluation of his/her Bid upon written request to the Contract Administrator.

B17.4 If no Contract is awarded, then the City of Winnipeg will pay the requested Bidder up to a maximum of five hundred dollars (\$500.00) for each of the requested submissions listed in E5 for the preparation and delivery of Shop Drawings. Delivery of the Shop Drawings to the City and payment of the above amounts will constitute full and final consideration of each party to the other and neither party will have any further liability to the other with respect to this Bid Opportunity.

PART C - GENERAL CONDITIONS

C0. GENERAL CONDITIONS

- C0.1 The *General Conditions for Construction* (Revision 2006 12 15) are applicable to the Work of the Contract.
- C0.1.1 The *General Conditions for Construction* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at http://www.winnipeg.ca/matmgt/gen_cond.stm
- C0.2 A reference in the Bid Opportunity to a section, clause or subclause with the prefix “**C**” designates a section, clause or subclause in the *General Conditions for Construction*.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of demolition of existing valve chambers and meter pit, construction of new valve chamber, construction and renewal of relating watermains and feeder mains.

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

- (a) Construction of a temporary 450 mm feeder main by-pass.
- (b) Construction of a 300 mm watermain connection to an existing feeder main.
- (c) Demolition of the existing Charleswood Feeder main offtake chamber at Haney Street and Eldridge Avenue.
- (d) Demolition of the existing meter pit at Haney Street and Eldridge Avenue.
- (e) Construction of a new valve chamber at Haney Street and Eldridge Avenue.
- (f) Connection of the existing Charleswood, Haney, Wilkes Avenue Feeder mains to new valve chamber.
- (g) Online renewal of existing 300 mm watermain on Eldridge Avenue and construction of a depressed section crossing the Wilkes Ave Feeder main.
- (h) Demolition of the existing Wilkes Avenue Feeder main offtake chamber.
- (i) Connection of the existing Charleswood-Assiniboia Feeder main to the new valve chamber.
- (j) Restoration works.

D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

- (a) "**AWWA**" means American Water Works Association;
- (b) "**NSF**" means National Sanitation Foundation definition;
- (c) "**ASTM**" means American Society for Testing and Materials;
- (d) "**CSA**" means Canadian Standards Association.
- (e) "**Wilkes Feeder main**" means the portion of Feeder main extending south along Haney Street from the Haney-Eldridge Intersection.
- (f) "**Charleswood Feeder main**" means the portion of Feeder main extending east along Eldridge Avenue from the Haney-Eldridge intersection.
- (g) "**Charleswood-Assiniboine Feeder main**" means the portion of Feeder main extending west along Eldridge Avenue from the Haney-Eldridge intersection.
- (h) "**Haney Feeder main**" means the portion of the Feeder main running north on Haney Street from the Haney-Eldridge intersection.

D4. CONTRACT ADMINISTRATOR

D4.1 The Contract Administrator is AECOM Canada Ltd., represented by:

Adam Braun, P.Eng.
Municipal Engineer
99 Commerce Drive
Winnipeg, MB R3P 0Y7

Telephone No. 204 928-9216
Facsimile No. 204 284-2040

D4.2 At the pre-construction meeting, Mr. Braun will identify additional personnel representing the Contract Administrator and their respective roles and responsibilities for the Work.

D4.3 Bids Submissions must be submitted to the address in B8.8.

D5. CONTRACTOR'S SUPERVISOR

D5.1 At the pre-construction meeting, the Contractor shall identify his/her designated supervisor and any additional personnel representing the Contractor and their respective roles and responsibilities for the Work.

D6. OWNERSHIP OF INFORMATION, CONFIDENTIALITY AND NON DISCLOSURE

D6.1 The Contract, all deliverables produced or developed, and information provided to or acquired by the Contractor are the property of the City and shall not be appropriated for the Contractors own use, or for the use of any third party.

D6.2 The Contractor shall not make any public announcements or press releases regarding the Contract, without the prior written authorization of the Contract Administrator.

D6.3 The following shall be confidential and shall not be disclosed by the Contractor to the media or any member of the public without the prior written authorization of the Contract Administrator;

- (a) information provided to the Contractor by the City or acquired by the Contractor during the course of the Work;
- (b) the Contract, all deliverables produced or developed; and
- (c) any statement of fact or opinion regarding any aspect of the Contract.

D6.4 A Contractor who violates any provision of D6 may be determined to be in breach of Contract.

D7. NOTICES

D7.1 Except as provided for in C23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.

D7.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D7.3, D7.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the facsimile number identified in D4.1.

D7.3 Notwithstanding C21., all notices of appeal to the Chief Administrative Officer shall be sent to the attention of the Chief Financial Officer at the following facsimile number:

The City of Winnipeg
Chief Financial Officer
Facsimile No.: 204 949-1174

- D7.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following facsimile number:

The City of Winnipeg
Legal Services Department
Attn: Director of Legal Services
Facsimile No.: 204 947-9155

D8. FURNISHING OF DOCUMENTS

- D8.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him/her at cost.

SUBMISSIONS

D9. AUTHORITY TO CARRY ON BUSINESS

- D9.1 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.

D10. SAFE WORK PLAN

- D10.1 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.
- D10.2 The Safe Work Plan should be prepared and submitted in the format shown in the City's template which is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Division website at <http://www.winnipeg.ca/matmgt/Safety/default.stm>
- D10.3 Notwithstanding B11.4 at any time during the term of the Contract, the City may, at its 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.

D11. INSURANCE

- D11.1 The Contractor shall provide and maintain the following insurance coverage:
- (a) commercial general liability insurance, in the amount of at least two million dollars (\$2,000,000.00) inclusive, with The City of Winnipeg added as an additional insured, with a cross-liability clause, such liability policy to also contain contractual liability, unlicensed motor vehicle liability, non-owned automobile liability and products and completed operations, to remain in place at all times during the performance of the Work and throughout the warranty period;
 - (b) if applicable, 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.
- D11.2 Deductibles shall be borne by the Contractor.

D11.3 The Contractor shall provide the City Solicitor with a certificate(s) of insurance, in a form satisfactory to the City Solicitor, at least two (2) Business Days prior to the commencement of any Work but in no event later than the date specified in C4.1 for the return of the executed Contract.

D11.4 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.

D12. PERFORMANCE SECURITY

D12.1 The Contractor shall provide and maintain performance security until the expiration of the warranty period in the form of:

- (a) a performance bond of a company registered to conduct the business of a surety in Manitoba, in the form attached to these Supplemental Conditions (Form H1: Performance Bond), in the amount of fifty percent (50%) of the Contract Price; or
- (b) an irrevocable standby letter of credit issued by a bank or other financial institution registered to conduct business in Manitoba and drawn on a branch located in Winnipeg, in the form attached to these Supplemental Conditions (Form H2: Irrevocable Standby Letter of Credit), in the amount of fifty percent (50%) of the Contract Price; or
- (c) a certified cheque or draft payable to "The City of Winnipeg", drawn on a bank or other financial institution registered to conduct business in Manitoba, in the amount of fifty percent (50%) of the Contract Price.

D12.1.1 Where the performance security is in the form of a certified cheque or draft, it will be deposited by the City. The City will not pay any interest on certified cheques or drafts furnished as performance security.

D12.2 The Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D13. SUBCONTRACTOR LIST

D13.1 The Contractor shall provide the Contract Administrator with a complete list of the Subcontractors whom the Contractor proposes to engage (Form J: Subcontractor List) at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D14. EQUIPMENT LIST

D14.1 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.

D15. DETAILED WORK SCHEDULE

D15.1 The Contractor shall provide the Contract Administrator with a detailed work schedule at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in C4.1 for the return of the executed Contract.

D15.2 The detailed work schedule shall consist of the following:

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

- D15.3 Further to D15.2, the 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) Construction of 450 Feedermain by-pass and 300 mm WM
 - (i) Initial shutdown of Haney Feedermain
 - (ii) Construction and testing
 - (iii) Final Shutdown of Haney Feedermain
 - (b) Charleswood Feedermain shutdown
 - (c) Construction of new valve chamber
 - (i) Demolition of existing Charleswood Feedermain offtake chamber and meter pit
 - (ii) Shoring Installation
 - (iii) Construction of base slab
 - (iv) Installation of chamber piping
 - (v) Construction of chamber walls and roof
 - (vi) Removal of Shoring and backfilling
 - (d) Charleswood Feedermain Tie-in
 - (e) Haney Feedermain Tie-in
 - (i) Shutdown of Haney Feedermain
 - (f) Wilkes Ave Feedermain Tie-in
 - (i) Installation and testing of Feedermain Piping
 - (ii) Installation and testing of WM Piping
 - (iii) Shutdown of Wilkes Ave Feedermain
 - (g) Charleswood-Assiniboia Feedermain Tie-In
 - (i) Shutdown of Charleswood-Assiniboia Feedermain
 - (ii) Demolition of existing Wilkes Ave Feedermain offtake chamber
 - (iii) Construction and testing of piping
 - (h) Restoration
 - (i) Substantial Performance
 - (j) Total Performance
- D15.4 Further to D15.2(a), the Gantt chart shall show the time on a weekly basis, required to carry out the Work of each trade, or specification division. The time shall be on the horizontal axis, and the type of trade shall be on the vertical axis.

SCHEDULE OF WORK

D16. COMMENCEMENT

- D16.1 The Contractor shall not commence any Work until he/she is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.
- D16.2 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 D9;
 - (ii) evidence of the workers compensation coverage specified in C6.15;
 - (iii) the Safe Work Plan specified in D10;
 - (iv) evidence of the insurance specified in D11;
 - (v) the performance security specified in D12;

- (vi) the Subcontractor list specified in D13;
 - (vii) the equipment list specified in D14; and
 - (viii) the detailed work schedule specified in D15.
- (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.

D16.3 The Contractor shall not commence the Work on the Site before October 1, 2013.

D16.4 The City intends to award this Contract by September 13, 2013.

D16.4.1 If the actual date of award is later than the intended date, the dates specified for Commencement, Critical Stages, Substantial Performance, and Total Performance will be adjusted by the difference between the aforementioned intended and actual dates.

D17. SCHEDULE RESTRICTIONS

D17.1 Feedermain shutdowns are scheduled based on a number of factors including routine maintenance and repair work, water demand, weather and other factors. The City shall endeavour to make the specified time periods available to the Contractor to schedule his Work requiring removal of a feedermain from service, without limiting the City's control over the operation of the regional water system to complete other work, maintain adequate system service and maintain the integrity of the infrastructure. The City shall reserve the right to cancel and/or delay these schedule dates at any time, due to any circumstances that could adversely affect water supply system operation, including but not limited to high water demand, abnormal weather, failures of related water system components and/or security concerns.

D17.2 The Contractor shall provide a minimum of ten (10) Working Days notice to the Contract Administrator, in writing, of requiring a shutdown. The City will endeavour to schedule the shutdown as requested, pursuant to D17.1.

D17.3 Water Shutdown Restrictions and Time Periods

- (a) Feedermain shutdowns will only be permitted during a period from September 15 to May 16 of a calendar year.
- (b) The following is a list of restrictions for proposed works;
 - (i) Feedermain shutdowns for tie-in's shall be limited to two (2) Calendar Days with the following exceptions:
 - (i) Charleswood-Assiniboine Feedermain shutdown is limited to five (5) Calendar Days.
 - (ii) The Charleswood Feedermain may be shut down at the offtake chamber at Laxdal Ave for the duration of the valve chamber construction work. The feedermain shall be put back into service once the chamber piping has been pressure tested and the Haney Feedermain has been tied-in.
 - (c) Shutdowns will be measured from the time the pipe is turned over to the Contractor by the City, until the pipe control is turned back to the City for refilling and testing.
 - (d) Changes to these criteria will not be permitted without the approval of City of Winnipeg Water and Waste Department.
 - (e) The shutdown windows listed in D17.3 shall be considered critical stages. Shutdowns exceeding those listed in D17.3 shall be subject to liquidated damages in accordance with D21.

D18. CRITICAL STAGES

D18.1 The Contractor shall achieve critical stages of the Work in accordance with the following requirements:

- (a) All feedermain shut downs with the exception of the Charleswood Feedermain shut down at the offtake chamber shall be considered critical stages.
- (b) Critical stages for feedermain shut downs shall be measured in calendar days from their mutually established commencement date.
- (c) The Charleswood-Assiniboine Feedermain shutdown shall be completed within five (5) Calendar Days.
- (d) All other feedermain shutdowns shall be completed within two (2) Calendar Days with the exception of the shut downs noted in a) and c) above.
- (e) The Charleswood Feedermain shut down at the offtake chamber at Laxdal Ave shall not be considered a critical stage and shall be shut down for the duration of the valve chamber construction work. The feedermain shall be put back into service once the chamber piping has been pressure tested and the Haney Feedermain has been tied-in.

D19. SUBSTANTIAL PERFORMANCE

- D19.1 The Contractor shall achieve Substantial Performance by May 16, 2014.
- D19.2 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.
- D19.3 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.

D20. TOTAL PERFORMANCE

- D20.1 The Contractor shall achieve Total Performance by June 13, 2014.
- D20.2 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.
- D20.3 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.

D21. LIQUIDATED DAMAGES

- D21.1 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 Working Day for each and every Working Day following the days fixed herein for same during which such failure continues:
 - (a) Critical Stages - one thousand five hundred dollars (\$1,500.00);
 - (b) Substantial Performance – Two Thousand dollars (\$2,000.00);
 - (c) Total Performance – Five Hundred dollars (\$500.00).
- D21.2 The amounts specified for liquidated damages in D21.1 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.

D21.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

CONTROL OF WORK

D22. JOB MEETINGS

D22.1 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.

D22.2 The Contract Administrator reserves the right to cancel any job meeting or call additional job meetings whenever he/she deems it necessary.

D23. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D23.1 Further to C6.24, the Contractor shall be the Prime Contractor and shall serve as, and have the duties of the Prime Contractor in accordance with The Workplace Safety and Health Act (Manitoba).

D24. THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA) – QUALIFICATIONS

D24.1 Further to B11.4, 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 its sole discretion and acting reasonably, require updated proof of compliance, as set out in B11.4.

MEASUREMENT AND PAYMENT

D25. PAYMENT

D25.1 Further to C12, the City may at its option pay the Contractor by direct deposit to the Contractor's banking institution.

WARRANTY

D26. WARRANTY

D26.1 Warranty is as stated in C13.

FORM H1: PERFORMANCE BOND
(See D12)

KNOW ALL MEN BY THESE PRESENTS THAT

_____ ,
(hereinafter called the "Principal"), and

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

_____ dollars (\$_____)

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

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

BID OPPORTUNITY NO. 645-2013

REPLACEMENT OF VALVE CHAMBER AND ASSOCIATED WORKS AT ELDRIDGE AVENUE AND HANEY STREET

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

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

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

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

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

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

_____ day of _____, 20____ .

SIGNED AND SEALED
in the presence of:

(Witness as to Principal if no seal)

(Name of Principal)

Per: _____ (Seal)

Per: _____

(Name of Surety)

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

**FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT
(PERFORMANCE SECURITY)**
(See D12)

(Date)

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 645-2013

REPLACEMENT OF VALVE CHAMBER AND ASSOCIATED WORKS AT ELDRIDGE AVENUE
AND HANEY STREET

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

(Name of Contractor)

(Address of Contractor)

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

_____ Canadian dollars.

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

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

Partial drawings are permitted.

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

(Address)

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

FORM K: EQUIPMENT
(See D14)

**REPLACEMENT OF VALVE CHAMBER AND ASSOCIATED WORKS AT ELDRIDGE AVENUE AND
HANEY STREET**

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

FORM K: EQUIPMENT
(See D14)

**REPLACEMENT OF VALVE CHAMBER AND ASSOCIATED WORKS AT ELDRIDGE AVENUE AND
HANEY STREET**

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

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS AND DRAWINGS

- E1.1 These Specifications shall apply to the Work.
- E1.2 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.
- E1.2.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management 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 Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.
- E1.3 The following are applicable to the Work:

<u>Appendix No.</u>	<u>Title</u>
A	Geotechnical Technical Memo - Site Investigation
B	Geotechnical Technical Memo - Excavation Recommendations
C	Existing Site and Chamber Photos

<u>Drawing No.</u>	<u>Drawing Name/Title</u>
	Cover Sheet
D-13292	Eldridge Avenue at Haney Street - Temporary Works, Staging and Demolition Plan
D-13293	Plan/Profile - Eldridge Avenue and Haney Street
D-13294	Valve Chamber - Sections
D-13295	Valve Chamber - Piping Details
D-13296	Valve Chamber - Concrete & Reinforcing Details

E2. SOILS INVESTIGATION REPORT

- E2.1 Further to C3.1, the geotechnical the following geotechnical memos are provided to aid the Contractor's evaluation of the pavement structure and/or existing soil conditions.
- (a) Site Investigation Technical Memo contained in Appendix A.
 - (b) Existing Valve Chamber Thrust Restraint Technical Memo contained in Appendix B.

GENERAL REQUIREMENTS

E3. OFFICE FACILITIES

- E3.1 The Contractor shall supply office facilities meeting the following requirements:
- (a) The minimum facility floor area shall be 12 square metres.
 - (b) The facility shall have a door with lockable hardware.
 - (c) The facility shall have lighting, heating and cooling provisions to maintain a temperature between 15°C and 25°C.
 - (d) The facility shall have a desk, chair and plan table, and file cabinet.
 - (e) Portable washroom facility with lockable door.
- E3.2 The office facilities will be provided from the date of the commencement of the Work to the date of Total Performance.

E3.3 Location of temporary office facilities shall be approved by the Contract Administrator.

E3.4 Measurement and Payment

E3.4.1 The Contractor shall be responsible for all installation and removal costs, all operating costs, and the general maintenance of the office facilities. No separate measurement or payment will be made.

E4. SHOP DRAWINGS

E4.1 Description

- (a) This Specification shall revise, amend, and supplement the requirements of CW 1100 of the City of Winnipeg's Standard Construction Specifications.
 - (i) The term "Shop Drawings: means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work.
 - (ii) The Contractor shall submit specified Shop Drawings to the Contract Administrator for review. All submissions must be in metric units. Where data is in imperial units, the correct metric equivalent shall also be shown on all submissions for Engineering review.
 - (iii) Provision of Shop Drawings will be considered incidental to the price for supply and delivery of equipment.
- (b) Shop Drawings
 - (i) Original drawings are to be prepared by the Contractor, Subcontractor, Supplier, Distributor, or Manufacturer, which illustrate the appropriate portion of Work; showing fabrication, layout, setting, or erection details as specified in appropriate sections.

E4.2 Contractor's Responsibilities:

- (a) Review shop drawings, product data, and samples prior to submission and stamp and sign drawings indicating conformance to the Contract requirements.
- (b) Verify:
 - (i) Field measurements
 - (ii) Field construction criteria
 - (iii) Catalogue numbers and similar data
- (c) Coordinate each shop drawing submission with the requirements of the Work and Contract Documents. Shop drawings of separate components of a larger system will not be reviewed until all related drawings are available.
- (d) Notify Contract Administrator, in writing at time of shop drawing submission, of deviations from requirements of Contract Documents.
- (e) Responsibility for deviations in Shop Drawing submission from requirements of Contract Documents is not relieved by the Contract Administrator's review of submission, unless the Contract Administrator gives written acceptance of specified deviations.
- (f) Responsibility for errors and omissions in the Shop Drawing submission is not relieved by the Contract Administrator's review of the submittals.
- (g) 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 the previous submission.
- (h) After the Contract Administrator has reviewed and returned the copies, distribute the copies to sub-trades as appropriate.

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

E4.3 Submission Requirements

- (a) Schedule to submit Shop Drawing submissions is within seven (7) Calendar days of a request as indicated in E5 or receipt of Notice of Award in accordance with B17, whichever is earlier, 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.
- (b) Submit five (5) paper prints of Shop Drawings. The Contractor is advised that the Contract Administrator will retain three (3) copies of all submittals and return two (2) copies to the Contractor.
- (c) Accompany shop drawing submissions with a transmittal letter containing:
 - (i) Date
 - (ii) Project title and Bid Opportunity number
 - (iii) Contractor's name and address
 - (iv) Number of each shop drawing, product data, and sample submitted
 - (v) Specification Section, Title, Number, and Clause
 - (vi) Drawing Number and Detail/Section Number
 - (vii) Other pertinent data
- (d) Shop drawing submissions shall include:
 - (i) Date and revision dates.
 - (ii) Project title and Bid Opportunity number.
 - (iii) Name of:
 - Contractor
 - Subcontractor
 - Supplier
 - Manufacturer
 - Separate detailer when pertinent
 - (iv) Identification of product or material.
 - (v) Relation to adjacent structure or materials.
 - (vi) Field dimensions, clearly identified as such.
 - (vii) Specification section name, number and clause number or drawing number and detail/section number.
 - (viii) Applicable standards, such as CSA or CGSB numbers.
 - (ix) Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements, and compliance with Contract Documents.

E4.4 Other Considerations

- (a) Fabrication, erection, installation, or commissioning may require modifications to equipment or systems to conform to the design intent. Revise pertinent shop drawings and resubmit.
- (b) Material and equipment delivered to the Site will not be paid for until pertinent shop drawings have been submitted and reviewed.
- (c) Incomplete shop drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.
- (d) No delay or cost claims will be allowed that arise because of delays in submissions, re-submissions, and review of shop drawings.

E5. EXPEDITED SHOP DRAWINGS

E5.1 Further to E4, in order to expedite Shop Drawings with critical timelines, the lowest responsive Bidder, as outlined in B16, will be required, after receiving a written request from the Contract Administrator, to arrange for the preparation of Shop Drawings for the following items with critical timelines:

- (a) Butterfly Valves and Actuators as per E16.
- (b) Ductile Iron Chamber Piping and Fittings as per E18

E5.2 If Award is made to the lowest responsive Bidder, then as per E4.1(a)(iii), no payment for the preparation of Shop Drawings will be made.

E6. ENVIRONMENTAL PROTECTION

E6.1 The Contractor shall be aware that the feeder mains are part of the City's potable water supply system and no contamination by fuel, chemicals, etc. shall be permitted at any time. Fuels or chemicals shall not be stored within 30 metres of feeder mains.

E6.2 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.

E6.3 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:

E6.3.1 Federal

- (a) Canadian Environmental Protection Act (CEPA) c.16
- (b) Transportation of Dangerous Goods Act and Regulations c.34

E6.3.2 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 Nuisance Act N120
- (f) The Public Health Act c.P210
- (g) The Workplace Safety and Health Act W120
- (h) And current applicable associated regulations.

E6.4 The Contractor is advised that the following environmental protection measures apply to the Work.

E6.4.1 Materials Handling and Storage

- (a) Construction materials shall not be stored within five (5) metres of a feeder mains centerline.

E6.4.2 Fuel Handling and Storage

- (a) Fuelling will not be permitted on Site.

E6.4.3 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) Indiscriminate dumping, littering, or abandonment shall not take place.
- (d) No on-site burning of waste is permitted.
- (e) Equipment shall not be cleaned near watercourses; contaminated water from onshore cleaning operations shall not be permitted to enter watercourses.

E6.4.4 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.

E6.4.5 Emergency Spill 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.
- (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) 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
 - (iii) 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
 - (iv) 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.

E6.5 Controlled Products

- (a) Materials classified as "Controlled Products" under Regulation 52/88, "Workplace Hazardous Materials Information System", including amendments, are prohibited inside feeder mains, unless the material will be directly employed in the Work.

- (b) Notwithstanding the aforementioned requirement, materials have been tested by an ANSI accredited laboratory and meet the requirements of ANSI/NSF 60, "Standard for Drinking Water Treatment and Chemicals – Health Effects", and ANSI/NSF 61, "Standard for Drinking Water System Components – Health Effects", including the patching repair material, and epoxy resin adhesive, as specified in the Specifications, shall be permitted inside feeder mains.

E7. PROTECTION OF EXISTING TREES

- E7.1 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.
- E7.2 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.
- E7.3 Except as required in clause E7.1(c) and E7.1(e), Elm trees shall not be pruned at any time between April 1 and July 31.
- E7.4 Measurement and Payment
 - E7.4.1 No separate measurement or payment will be made for the protection of trees.

E8. TRAFFIC MANAGEMENT

- E8.1 Further to clause 3.7 of CW 1130:
 - E8.1.1 Should the Contractor be unable to maintain pedestrian or vehicular access to a residence or business, he/she shall review the planned disruption with the business or residence and the Contract Administrator, and take reasonable measures to minimize the impact. The Contractor shall provide a minimum of 24 hours notification to the affected residence or business and the Contract Administrator, prior to disruption of access.
 - E8.1.2 The Contractor shall strive to maintain one lane of traffic in both directions during construction. Provide notice of complete street shutdowns complete with dates and duration a minimum of five (5) working days prior to street shutdown.

E9. OPERATING CONSTRAINTS FOR WORK IN CLOSE PROXIMITY TO FEEDERMAINS

E9.1 Description

- (a) This Section details operating constraints for all Work to be carried out in close proximity to feeder mains. Close proximity shall be deemed to be any construction activity within a 5 m offset from the centreline of the feeder main.

E9.2 General Considerations for Work in Close Proximity to Feeder mains

- (a) Feeder mains are a critical component 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. Inadvertent damage caused to the pipe would likely have catastrophic consequences.
- (b) Work around 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. Prestressed pipe typically fails in a non-ductile mode and has the potential to cause extensive consequential damage to infrastructure if failure should occur.

E9.3 Impacted Feeder mains

- (a) The Charleswood Feeder main is constructed from 600 mm prestressed concrete cylinder pipe (lined core) conforming to AWWA Standard C301. The Charleswood Feeder main was manufactured and installed in 1958.
- (b) The Haney Feeder main is constructed from 450 mm asbestos cement pipe conforming to AWWA Standard C400. The Haney Feeder main was manufactured and installed in 1960.
- (c) The Charleswood-Assiniboia Feeder main is constructed from 750 mm prestressed concrete cylinder pipe (lined core) conforming to AWWA Standard C301. The Charleswood Assiniboia Feeder main was manufactured and installed in 1964.
- (d) The Wilkes Avenue Feeder main is constructed from 750 mm prestressed concrete cylinder pipe (lined core) conforming to AWWA Standard C301. The Wilkes Avenue Feeder main was manufactured and installed in 1966.

E9.4 Submittals

- (a) Submit proposed construction equipment specifications to the Contract Administrator for review seven (7) days prior to construction. Submittal shall include:
 - (i) Equipment operating weight and dimensions including wheel or track base, track length or axle spacing, track widths or wheel configurations
 - (ii) Payload weights
 - (iii) Load distributions in the intended operating configuration
- (b) Submit a Construction Method Statement with proposed construction plan including haul routes, excavation equipment locations, loading positioning, to the Contract Administrator for review seven (7) days prior to construction. Do not commence construction until the Construction Method Statement has been reviewed and accepted by the Contract Administrator.

E9.5 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 feeder main locations have been clearly delineated in the field. Work over feeder mains shall only be carried out with equipment that has been reviewed and quantified in terms of its loading implications on the pipe.

- (b) All proposed construction equipment must be submitted to Contract Administrator for review prior to construction. Work in areas in close proximity to feeder mains shall only be carried out with equipment that has been reviewed and quantified in terms of its loading implications by the Contract Administrator.
- (c) Contact the City of Winnipeg WWD Department, Construction Services Coordinator (Duane Baker) prior to construction.
- (d) Where Work is in close proximity to a feeder main, utilize construction practices and procedures that do not impart excessive vibration loads on the feeder main or that would cause settlement of the subgrade below the feeder main.
- (e) At all times prior to completion of final paving; reduce equipment speeds to levels that minimize the effects of impact loading to the pipe
- (f) For construction work activities either longitudinally or transverse to the alignment of a feeder main, work only with equipment and in the manner stipulated in the accepted Construction Method Statement and the supplemental requirements noted herein.
- (g) Where Work is in proximity to a feeder main, utilize construction practices and procedures that do not impart excessive vibration loads on the feeder main or that would cause settlement of the subgrade below the feeder main.
- (h) 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).
- (i) Granular material, construction material, soil or other material shall not be stockpiled on the pipelines or within 5 metres of the pipe centerline.
- (j) The Contractor shall make himself fully aware of all associated restrictions, constraints, and risks associated with working adjacent to and over this pipeline.
- (k) The Contractor shall ensure that all crew members understand and observe the requirements of this specification. Prior to commencement of on-site work, the Contractor shall jointly conduct an orientation meeting with the Contract Administrator and all superintendents, foreman, and heavy equipment operators to make all workers on Site fully cognizant of the limitations of altered loading on, the ramifications of inadvertent damage to, and the constraints associated with Work in close proximity to the feeder mains. New personnel introduced after commencement of the project need to be formally orientated as to the risks and constraints associated with working over the feeder main.

E9.6 Restrictions for working in close proximity to live feeder mains or feeder mains which are to remain in service. Depressurized feeder mains identified for removal or abandonment are exempt from the following:

- (a) Use of pneumatic concrete breakers within 3 metres of a feeder main is prohibited. Pavement shall be full depth sawcut and carefully removed. Use of hand held jackhammers for pavement removal will be allowed.
- (b) Where demolition of existing underground structures requires the use of pneumatic concrete breakers within 3 m of a feeder main (which is to be put back into service), the Contractor shall physically isolate the feeder main by removing a section of the pipe. The section of pipe to be removed must be previously identified to be removed and isolating the feeder main shall not result in the installation of additional pipe.
- (c) Where there is less than 1.6 metres of earth cover over a feeder main and further excavation is required either adjacent to or over the feeder main, utilize only smooth edged excavation buckets, soft excavation or hand excavation techniques. Where there is less than 1 metre of cover over the feeder main, carefully expose the feeder main by hand excavation to delineate the location and depth of the main, and provide full time supervision of the excavation.
- (d) Where there is less than 2.5 m of earth cover over a feeder main, offset backhoe or excavation equipment from the feeder main, a minimum of 3 m from centerline, to carry out excavation.

- (e) Equipment should not be allowed to operate while positioned directly over a feedermain.

E9.7 Subgrade Construction

- (a) Subgrade, sub-base and base course construction shall be kept in a rut free condition at all times. Construction equipment is prohibited from crossing pipelines if the grade is insufficient to support the equipment without rutting.

E9.8 Subbase and Base Course Construction

- (a) Subbase or base course materials shall not be dumped directly on pipelines but shall be stockpiled outside limits noted in these recommendations and shall be carefully bladed in-place.
- (b) Subbase compaction within 3 metres of the centreline of a feedermain shall be either carried out by static methods (without vibration) or with smaller approved equipment such as hand held plate packers or smaller roller equipment.

E9.9 Asphalt and Surface Treatment Pavement Construction

- (a) When constructing asphalt and surface treatment pavements only non-vibratory compaction should be used within 3 metres of the centre of the pipeline.

E10. EXCAVATION, DEMOLITION AND BACKFILL

E10.1 Description

- (a) This Specification covers the requirements for excavations, demolition and backfilling of trenches and structures.

E10.2 Submittals

- (a) Shop drawings for all excavation shoring shall be prepared and submitted in accordance with E4. All shop drawings shall be sealed by a Professional Engineer, registered in the Province of Manitoba, experience in the design of excavation shoring systems.

E10.3 Shoring Design

- (a) Excavation shoring shall be designed to accommodate installation of all pipe and fittings.

E10.4 Demolition

E10.4.1 Demolish existing concrete structures as shown on the Drawings and as follows.

- (a) Carefully remove all couplings, valves, and fittings and return to a designated City of Winnipeg facility.
- (b) Base slabs for existing valve chambers may be left in place where they do not interfere with proposed feedermain piping or valve chamber construction.
- (c) Chamber roof slabs, walls, and internal piping shall be completely removed.

E10.4.2 Removal of asbestos cement pipe.

- (a) Demolition and disposal of existing asbestos cement pipelines shall be completed in compliance to Workplace Health and Safety regulations.

E10.5 Excavation

- (a) Excess excavation from trenching operations shall be disposed of off-site.
- (b) Granular bedding in the vicinity of existing pipelines shall be dewatered and stabilized prior to undermining pipes to prevent loss of granular pipe foundation.
- (c) Pipelines less than 400 millimetres in diameter, under pavements excluding walkways, shall be installed by trenchless methods.

E10.6 Backfill

- (a) Backfill within 1 m of existing and proposed pavements shall be completed to CW 2030, Class 2 standards. Granular backfill shall extend to the underside of the proposed pavement structure, as indicated on the drawings. The remaining trench backfill shall be completed to existing grade to CW 2030, Class 4 standards.
- (b) Backfill under proposed paths and walkways shall be completed to CW 2030, Class 4 standards.
- (c) Backfill within 1 metre of existing and new concrete structures shall be completed with free draining pit run granular material to CW 2030, Class 2 standards. The top 600 millimetres of the backfill adjacent to concrete structures shall be insitu clay material completed to CW 2030, Class 4 standards.
- (d) Pipe bedding and backfill of parallel trenches in the vicinity of thrust blocks shall be carefully backfilled to the levels shown on the drawings with crushed granular backfill conforming to CW 2030 Type 2 material, and thoroughly compacted to CW 2030 Class 2 standards.

E10.7 Site Restoration

- (a) Restore existing concrete pavement and asphalt overlay on Haney Street in accordance with CW 3410.
- (b) Restore existing chip sealed road surfaces on Haney Street and Eldridge Avenue in accordance with E11.
- (c) Sod existing grassed areas disturbed by construction in accordance with CW 3510.

E10.8 Measurement and Payment

- (a) Excavation, shoring, and backfilling for pipe installation and valve chamber construction will not be measured for payment. Costs for excavation and shoring shall be included in the price for installation of feeder mains, water mains and the valve chamber. No separate measurement or payment will be made.
- (b) Demolition of existing concrete structures shall be paid as a Lump Sum for each chamber as listed in the Form B Prices for under the Contract Lump Sum Price for "Demolition of Existing Valve Chambers", 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.
- (c) Surface restoration will be paid as follows:
 - (i) Concrete and asphalt pavement restoration in accordance with CW 3410.
 - (ii) Existing chip sealed road surfaces in accordance with E11.
 - (iii) Sodding in accordance with CW 3510
 - (iv) Payment for restoration works will be limited to areas disturbed to facilitate construction. Surface restoration outside of the designated construction areas shall be at the Contractors expense.

E11. ASPHALT SURFACE TREATMENT

E11.1 Description

- (a) This specification covers the supply and placement of asphalt surface treatment.

E11.2 Materials

- (a) Asphalt surface treatment shall be processed through a wash plant to remove fines and dust. The cost of the washing operation shall be included in the cost of the material. The asphalt surface treatment material will conform to the following grading requirements:

CANADIAN METRIC SIEVE SIZE	PERCENT OF TOTAL DRY WEIGHT PASSING EACH SIEVE 100 MM MAX. AGGREGATE
10 000	100%
5 000	30 – 85%
2 500	0 – 20
1 250	0 – 10
80	0 - <1

- (b) **Note:** Traffic Gravel and Seal Coat (Aggregate) Material when subjected to the abrasion test will have a loss of not more than 35% when tested in accordance with Grading B of ASTM (American Society for Testing and Materials) C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine. As well, the aggregate retained on the No. 5 000 sieve will contain not less than 35% crushed aggregate as determined by actual particle count. Crushed aggregate will be considered as that aggregate having at least one fractured face.
- (c) Emulsified asphalt shall be HF 150S emulsion.

E11.3 Equipment

- (a) The Contractor shall ensure as a minimum, the following equipment is on site:
- (i) Asphalt surface treatment oil distributor
 - (ii) Asphalt surface treatment aggregate material spreader
 - (iii) Steel drum roller – vibratory
 - (iv) Rubber tired wobbly roller – self-propelled
 - (v) Loader
 - (vi) Sweeper

E11.4 Construction Methods

E11.4.1 Surface Preparation

- (a) Ensure base course material is properly shaped and bladed. Final surface shall be crowned to provide proper drainage, shall be free of potholes and washboard and tight. The base course shall be well mixed with little segregation of coarse material.

E11.4.2 Asphalt Surface Treatment

- (a) Emulsion shall be applied at a temperature as specified in the manufacturer's requirements and at a rate of 1.35 litres per square metre. Emulsion shall not be sprayed wider than the width of which the aggregate will be placed in a single pass. Spraying of the emulsion shall not precede the distribution of asphalt surface treatment material by more than 750 m, and shall be applied on a clean dry surface on a day when the atmosphere temperature is not less than 5°C.
- (b) Spread asphalt surface treatment material with a chip spreader at a uniform thickness immediately on the freshly placed oil. Aggregate shall be applied evenly to cover the emulsion to the approval of the Contract Administrator.
- (c) The Contractor shall roll the entire surface with a steel drum roller to embed the chips.
- (d) Finish rolling shall take place with rubber tired wobbly rollers to the satisfaction of the Contract Administrator.
- (e) Once the oil has cured, remove excess loose chips with sweeper as directed by the Contract Administrator.

E11.5 Measurement and Payment

- (a) The supplying, placing, rolling, and finishing of two lifts of asphalt surface treatment will be measured on an area basis and paid for at the Contract Unit Price per square metre for "Asphalt Surface Treatment". The area to be paid for will be the total number of square metres of asphalt surface treatment placed in accordance with this specification, accepted and measured by the Contract Administrator. Payment shall include supplying all materials and performing all operations herein described and all other items incidental to the Work included in this Specification.

E12. TEMPORARY THRUST BRACING

E12.1 Description

- (a) This Specification covers the requirements for temporary thrust bracing of feeder mains during construction.

E12.2 Submittals

- (a) Shop drawings for the temporary bracing listed in E12.3 shall be prepared and submitted in accordance with E4. All shop drawings shall be sealed by a Professional Engineer, registered in the Province of Manitoba, with experience in the design of excavation shoring and restraint systems.

E12.3 Temporary thrust bracing is required but not limited to the following locations and stages of construction:

- (a) Installation of temporary plug on the 450 mm Haney Feedermain during construction of Temporary 450 mm feedermain by-pass and 300 mm watermain piping.
- (b) 90 deg bend on temporary 450 mm feedermain by-pass prior to tie-in of the Haney Feedermain to the proposed valve chamber piping.
- (c) Wilkes Ave Feedermain offtake chamber must be restrained from movement during construction of the proposed valve chamber due to removal of soil from the east side of the existing chamber.

E12.4 Temporary thrust bracing must be designed to handle the following thrust forces:

- (a) 750 mm Feedermain – 377 kN (84,825 lb)
- (b) 600 mm Feedermain – 241 kN (54,288 lb)
- (c) 450 mm Feedermain – 136 kN (30,537 lb)

E12.5 Measurement and Payment

- (a) Temporary thrust restraint systems for pipe installation and valve chamber construction shall be considered incidental to the Work and no separate measurement or payment will be made. Costs for temporary thrust restraint shall be included in the price for installation of feeder mains and valve chambers.

E13. SUPPLY AND DELIVERY OF PRESTRESSED CONCRETE PIPE AND APPURTENANCES

E13.1 Description

- (a) This Specification supplements and amends AWWA Specification C301, AWWA Manual M9 Concrete Pressure Pipe, and AWWA C304 Design of Prestressed Concrete Cylinder Pipe.

E13.2 Materials

- (a) Cement
 - (i) Portland Cement shall be Type HS Sulphate resistant Cement.
 - (ii) External mortar coating shall contain 10 percent silica fume by weight of cement.

- (iii) Approval in writing is required if the Contractor proposed to use fly ash or pozzolan as a supplementary cementing material in conformance with AWWA Standard C301, Section 4.4.1.
- (iv) Approval requests should be accompanied by a submission from an independent testing laboratory complete with sampling and testing results of the material conforming to ASTM Standard C311.
- (b) Bell and Spigot Joint Rings
 - (i) All joints shall utilize snap ring style restraint system or approved equal in accordance with B7.
 - (ii) All joints shall be individually testable utilizing a double O-ring.
- (c) Fittings
 - (i) Fittings shall be manufactured using minimum steel thicknesses specified in Table 1, Section 4.7 of AWWA C301.
 - (ii) Flanges for fittings shall be AWWA C207 minimum Class D Flanges.
 - (iii) Pipe sections passing through valve chamber walls shall be manufactured with a minimum 12 mm thick by 150 mm wide steel thrust ring, located at the midpoint of the chamber walls, of adequate design to resist specified design forces.
- (d) Prestressed Concrete Cylinder Pipe Connections to Existing Feeder mains
 - (i) For connection to existing 900 mm pipe joints, standard single gasket joints will be permitted. Existing joint diameter and joint depth are provided on the Drawings. 'O' ring size is unknown and to be determined by the Contractor.
- (e) Pipe Marking
 - (i) Each section of pipe and each fitting shall be plainly marked with a waterproof marking material both inside, on the bell or spigot end, and outside, at the pipe's midspan, the classification, the date of manufacture and marks of identification sufficient to show its proper location in the line by the reference to the laying schedule specified. The point of maximum bevel shall be marked on the end of the spigot on each piece of bevelled pipe. All bends shall be marked on the ends with the angle of deflection. The manufacturer's proposed marking system shall be included with the "Data to be Supplied by Contractor" in E13.4. Colour coded markings shall be required when there is more than one pipe classification.
- (f) Closures
 - (i) Buried pipe closures shall be welded split steel sleeve closures.
 - (ii) The plain steel end of each closure piece shall extend 150mm longer than the required length of the piece to provide an overlap in order to compensate for any correction required when installed.
 - (iii) The Contractor shall be responsible for any interior or exterior mortar coating damage.
 - (iv) Each pipe run shall be designed with a minimum of one (1) closure section. The closure section location will be left to the Contractor, subject to approval of the Contract Administrator, to best suit proposed installation sequencing.

E13.3 Design Requirements

- (a) Pipe Design
 - (i) The Contractor shall submit details of the pipe design for approval of the Contract Administrator prior to manufacture. Where pipe runs contains more than one pipe class, pipe marking system shall clearly indicate different pipe classes.
 - (ii) All pipe and fittings shall be design and constructed to withstand maximum design working pressure of 700 kilopascals, a test pressure of 1000 kilopascals, and all external pressures caused by overburden, traffic or other loads to which the pipe might be subjected, all in accordance with the applicable requirements of AWWA Standard C301 and C304.

- (iii) Soil loads shall be calculated using Heger positive projection loads, a soil weight of 1925 kilograms per cubic metre, a ASTM C1479 Type 2 installation, and earth cover as indicated on the drawings (minimum earth cover of 2750 millimetres). Depth of cover requirements shall use the maximum of proposed final grades or original ground grades. Live loading under proposed roadways shall allow for HSS-25 highway loading.
 - (iv) The steel cylinder shall be a minimum of 1.6 millimetre thickness (No. 16 gauge) and the minimum thickness of the high tensile reinforcing wire shall be 4.2 millimetres thick (No. 8 gauge). Mortar coating shall be a minimum of 24 millimetres thick measured from the outside of the high tensile wire.
- (b) Laying Schedule
- (i) Pipe laying schedule shall incorporate a short pipe length as indicated on the Drawings, immediately outside of valve chamber piping.
 - (ii) Minor adjustments to pipe design plans to suit standard pipe lengths, may be allowed on approval of the Contract Administrator.
 - (iii) Pipe closures shall be field measured prior to fabrication.
 - (iv) Laying schedules shall incorporate sufficient person access points to safely facilitate pipe access for joint grouting and inspection.
- (c) Fitting Design
- (i) Fittings shall be designed to accommodate the horizontal and vertical deflections shown on the Drawings. Where combination horizontal and vertical bends are used, fitting orientation shall be clearly marked on the fitting to aide in installed alignment.

E13.4 Data to be Supplied by Contractor

- (a) Sufficient numbers of copies of all drawings and laying schedules as specified in Specification CW 1110, Clause 1.5, shall show full details of reinforcement, concrete and joint dimensions for the straight pipe, specials and connections and shall be furnished by the Contractor for the review by the Contract Administrator. No pipe shall be manufactured until the drawings have been entirely approved.
- (b) The data submitted by the Contractor shall include a tabulated laying schedule with reference to the stationing and grade lines shown on the Drawings. This schedule shall show the locations and length of each class of pipe which the Contractor proposes to furnish, and the point of change from one class to the next shall be clearly indicated by station number. The area of steel per linear metre and such other details as are required shall be listed for each of the pipe classes proposed by the Contractor.
- (c) The Contractor shall be responsible for the accurate details, fabrication and fit of the pipe and specials.
- (d) The Contractor shall submit to the Contract Administrator for review, design calculations for the determination of the details of the pipe reinforcement prior to the manufacture of any pipe. The Contractor shall obtain sufficient data to verify all pipe design strengths from the manufacturer of the pipe.
- (e) The Contractor shall provide complete Record Drawings for the pipe, including revised laying schedules, closure lengths for field trimmed pieces or other modifications required for the pipe installation.

E13.5 Delivery of Pipe

- (a) Contractor is required to coordinate manufacture and delivery of the pipe with his sub-contractor (the manufacturer) and to meet project scheduling requirements.
- (b) Delivery of the pipe shall be in accordance with AWWA M9 Manual – Concrete Pressure Pipe.

E13.6 Construction Methods

(a) Pipe Length

- (i) Standard pipe lengths shall be used, except where special lengths are required by an approved laying schedule.

(b) Tolerances

- (i) In addition to the requirements noted in Section 4.5 of AWWA C301, the overall length of pipe measured from the end of the spigot to the seat of the bell at any point around the circumference shall not vary more than 3 millimetres +/-.
- (ii) The Contractor shall accurately measure and confirm pipe bell and spigot tolerances, and ensure pipe mating, prior to shipping pipe. The Contractor shall provide a written report of pipe bell and spigot measurements.

E13.7 Quality Control

(a) Inspection

- (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 in accordance with the provisions of GC 5.03.

(b) Testing of Pipe and Materials

- (i) The Contractor shall provide access to the Contract Administrator or his appointed representative to conduct plant inspections, in accordance to Section 5.1 of AWWA C301. The Contractor shall provide a minimum of 7 calendar days notice of commencement of pipe manufacture, for the purposes of scheduling plant inspections.
- (ii) The Contract Administrator reserves the right to conduct third party quality control testing.
- (iii) The Contractor shall make, conduct, arrange, make available, obtain and provide for all testing as described in Section 5.2 AWWA Standard C301-99. The following reports shall be made available to the Contract Administrator on request:
- (iv) Absorption tests shall be carried out by the Contractor on specimens of the exterior coating of the pipe. These tests shall be carried out in accordance with ASTM Standard C497 Method of Testing Concrete Pipe, Sections or Tile, method A.
 - ◆ Notwithstanding AWWA C301 4.6.8.3, no individual absorption test may exceed 10%.
 - ◆ Notwithstanding AWWA C301 4.6.8.3, mortar tests shall be conducted on a daily basis for the entire production run.
 - ◆ Every effort shall be taken to limit this absorption to 8% as measured in accordance with the ASTM Standard C497. The City will not accept pipe with an absorption rate in excess of 10%. No pipe shall be shipped until the absorption results related to the particular shipment have been provided to the Contract Administrator, and are satisfactory.

(c) Testing of Fittings and Special Pipe

- (i) Fittings and special pipe shall be tested in the same manner as pipe except that fittings and special pipe shall be tested for tightness by the dye penetrant method as specified in Section 4.7.2.22 of AWWA Standard C301.

(d) Affidavit of Compliance

- (i) 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, in accordance with Section 6.3 of AWWA C301.

E13.8 Measurement and Payment

(a) Prestressed Concrete Pressure Pipe

- (i) The supply and delivery of prestressed concrete pressure pipe shall not be measured for payment. It shall be included in the price bid for "Supply and Install Feedermain Piping".

(b) Fittings and Specials

- (i) The supply and delivery of fittings and specials shall not be measured for payment. They shall be included in the price bid for "Supply and Install Feedermain Piping".

E14. SUPPLY AND DELIVERY OF LARGE DIAMETER POLYVINYLCHLORIDE PIPE

E14.1 Description

- (a) This section of the Specification covers the supply of 450, 600, and 750 mm Poly-Vinyl Chloride Pipe.

E14.2 Materials

E14.2.1 Poly-Vinyl Chloride (PVC) Pipe

(a) Dimension Ration (DR)

- (i) PVC pipe shall conform to the latest revision of AWWA C905 and CSA B137.3, with the following dimension ratios (DR)
 - ◆ 750 mm DR 25
 - ◆ 600 mm DR 18
 - ◆ 450 mm DR 18

(b) Fabricated Fittings

- (i) Fabricated fittings shall be thermally butt or solvent welded segments, with overwrapped reinforcement, conforming with AWWA C905 and CSA B137.3. Where non-standard fittings and bend angles are required, fittings shall be constructed in every way to conform to the nearest CSA certified standard fitting.

(c) Closures

- (i) Main line closures shall be fabricated PVC slide collars conforming to AWWA C905 and CSA B137.3. Pipe class to be the same as for mainline piping.

E14.2.2 Submittals

(a) Laying Schedule

- (i) Submit laying schedule for review by the Contract Administrator. Laying schedule shall show general pipe layout, location of fittings and specials, proposed direction of lay and connection points.
- (ii) Minor adjustments to pipe design plans to suit standard pipe lengths, may be allowed on approval of the Contract Administrator.

(b) Fittings

- (i) Submit details of all fabricated fittings and specials, including details of proposed connections to existing pipelines.

(c) Affidavit of Compliance

- (i) 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, in accordance with Section 6.3 of AWWA C905.

E14.2.3 Quality Control

(a) Inspection

- (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 in accordance with the provisions of GC 5.03.

(b) Testing of Pipe and Materials

- (i) The Contractor shall provide access to the Contract Administrator or his appointed representative to conduct plant inspections, in accordance to Section 5.3 of AWWA C905. The Contractor shall provide a minimum of 7 calendar days notice of commencement of pipe manufacture, for the purposes of scheduling plant inspections.
- (ii) The Contract Administrator reserves the right to conduct third party quality control testing.

(c) Dimensional Checks

- (i) Notwithstanding AWWA C905, Section 5.1.1, dimensional checks shall be carried out for each and every pipe in the production run.

E14.3 Method Measurement and Basis of Payment

(a) AWWA C905 Pressure Pipe

- (i) The supply and delivery of AWWA C905 PVC pipe shall not be measured for payment. It shall be included in the price bid for "Supply and Install Feedermain Piping".

(b) Fittings and Specials

- (i) The supply and delivery of fittings and specials shall not be measured for payment. They shall be included in the price bid for "Supply and Install Feedermain Piping".

E15. SUPPLY AND INSTALLATION OF FEEDERMAINS

E15.1 Description

- (a) This Specification shall cover the preparation of the pipe bed, including the supply of bedding materials and the placement of all pipe and accessories including fittings, as specified or shown on the Drawings.

E15.2 Materials

(a) Acceptable Feedermain Products

- (b) Prestressed Concrete Pressure Pipe conforming to E13 and AWWA C301
- (c) 450, 600, and 750 mm Poly Vinyl Chloride (PVC) conforming to E14, AWWA C905 and CSA B137.3

E15.2.1 Pipe Couplers

- (a) Pipe couplers for pipe connections to chambers shall be to the latest revision of AWWA C-219 for bolted, Sleeve Type Couplers for Plain End Pipe. Minimum requirements are:
 - ◆ Minimum sleeve length 250 mm
 - ◆ Minimum centre sleeve thickness 12.7 mm
 - ◆ Couplings capable of accommodating up to 2 degrees deflection
 - ◆ Bolts and nuts to be 316 Stainless Steel.
 - ◆ Design pressure 150 psi
- (b) Buried pipe couplers shall be protected against corrosion by wrapping with Denso Tape system, consisting of Denso Profiling Mastic, Denso Paste and Densyl Tape, or approved equal in accordance with B7.

- (c) Couplings to be supplied with two di-electric insulating boots.
- (d) Couplings to be fusion bonded epoxy coated to AWWA C213, and meeting the requirements of ANSI/NSF 61 "Standard for Drinking Water System Components – Health Effects"
- (e) All transition couplers shall be restrained.

E15.2.2 Joint Restraint Harnesses

- (a) Utilize joint restraint harnesses specially designed for PVC

E15.2.3 Paint

- (a) Paint for exposed metal surfaces shall be in accordance to AWWA C213.
- (b) Interior coatings shall comply with ANSI/NSF 61 "Drinking Water System Components – Health Effects"
- (c) Coating shall be two (2) or more layers (5 mils minimum each coat) Polyamide Epoxy, Amerlock 400, Tnemec Series 140F Pota-Pox Plus or approved equal in accordance with B7.

E15.3 Construction Methods

E15.3.1 Excavation

- (a) Excavation shall be in accordance with Specification CW2030, "Excavation, Bedding and Backfill". Over-excavated material shall be replaced with compacted, well-graded crushed limestone having a maximum aggregate size of 100mm, conforming to CW 3110, compacted to 95% SPD as shown on the Drawings for pipe foundation.

E15.3.2 Pipe Installation – AWWA C301 Pipe

- (a) Installation of Pipe
 - (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) Pipe bedding structure shall meet an ASTM C1479 Type 2 installation except as modified herein and on the Drawings.
 - (iii) 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. Another groove shall be provided at each joint to facilitate placing of a "diaper" band around the joint. Both grooves shall be filled with sand after the removal of the sling and after placing of the diaper band.
 - (iv) 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.
 - (v) Compacted sand backfill shall be placed above the pipe to a depth of 200 millimetres above the top of the pipe, for the full trench width. Backfill shall be compacted to a minimum of 90% SPMDD. The Contractor shall ensure that disturbance of the pipe or damage to the pipe coating does not occur during sand bedding and backfilling operations.
 - (vi) Pipe shall be installed utilizing trench methods. Coring, augering or jacking methods shall not be undertaken without approval of the Contract Administrator.
 - (vii) The exposed end of the pipe shall be fully protected with an approved stopper to prevent foreign matter from entering the pipe. The interior of the pipe shall be kept free of all dirt, concrete or superfluous material as the Work proceeds.

(b) Jointing

- (i) Immediately prior to connecting two lengths of pipe, the spigot end of the pipe shall be thoroughly cleaned. Prior to insertion of the rubber gasket in the spigot groove, the spigot groove shall be lubricated with vegetable soap. The gasket shall then be thoroughly cleaned and then lubricated with a vegetable soap approved by the pipe manufacturer, the consistency of which shall be approximately that of soft No. 2 cup grease. In stretching the gasket, care shall be exercised to maintain a uniform tension or volume of rubber around the whole circumference of the spigot. The bell of the pipe already in place shall be carefully cleaned and lubricated with vegetable soap.
- (ii) The spigot shall then be pushed into the bell and against steel inserts placed between the top of the spigot and the shoulder of the bell to provide a space for inserting the feeler gauge. The entire circumference of the joint shall be gauged to determine that the rubber gasket is in its proper position. If the gasket cannot be felt all around the pipe, the pipe shall be withdrawn and the gasket examined for cuts. If the gasket is undamaged it may be reused, but only after the bell ring and gasket have been lubricated with soap again, as previously specified, before the pipe is re-laid. When it has been determined that the gasket is in its proper position, the steel inserts shall be removed and the pipe pushed completely "home".
- (iii) Diaper bands to hold grout in place shall be used according to the manufacturer's instructions. Immediately before pouring cement grout, the entire joint shall be thoroughly wetted. A cement grout of one part Sulphate-Resistant cement to two parts sand shall be poured between the diaper and the pipe, to ensure a thorough sealing of the joint around the portion of the pipe covered by the band. Silt, slush, water or polluted mortar grout shall be carefully forced out by the pouring and removed. The upper portion of the joint shall then be filled with mortar and a bead made around the outside of the top half of the pipe joint with a sufficient amount of additional mortar. The completed joints shall immediately be protected from the air, sun or cold with proper coverings and shall be kept protected for such a period as necessary to secure satisfactory curing of the mortar. No backfilling around joints shall be done until the joints have fully cured.
- (iv) The inside joint recess of the concrete pipe, sizes 600 millimetres and larger, shall be completely filled with mortar made from one part cement and one part sand so as to provide a smooth continuous flush surface across the joint. The Contractor shall comply with all requirements and regulations of the Workplace, Safety and Health Division concerning air supply for workers performing operations inside the pipe and any associated costs shall be considered incidental to the installation.
- (v) Delay grouting and diapering of short pipe joints immediately outside of chambers, until completion of construction and partial backfill of chamber, to allow maximum differential deflection and settlement prior to final backfill.

(c) Steel Split Ring Closures

- (i) Plain end wall pieces shall be accurately trimmed after installed, to accommodate plain end by flange valve adaptors. The pipe shall be accurately marked around the circumference, from the face of the butterfly valve flanges, to accommodate the flange by plain end adaptor, plus gap allowance shown on the drawings.
- (ii) Buried pipe closures shall be accurately measured, cut and installed. Welded Split Sleeve closures shall be installed by a certified welder.
- (iii) Completed field welds shall be inspected by a certified welding inspector, using magna-flux methods or other methods approved by the Contract Administrator. A detailed inspection report including test data shall be submitted to the Contract Administrator within 5 Business Days of completion of testing.

- (d) Connection to Chamber Piping
 - (i) For AWWA C301 pipe, connection to chamber piping of similar pipe materials may be made by means of bell and spigot joints.
 - (ii) For AWWA C301 pipe connection to dissimilar chamber piping, connections shall be made by means of steel sleeve typed coupling. Pipe coupling to be protected from corrosion by Denso tape system.

E15.3.3 Pipe Installation - AWWA C905 PVC

- (a) Installation of Pipe
 - (i) Pipe bedding structure shall meet the requirements of ASTM D2321 except as modified herein and on the Drawings.
 - (ii) The sand bedding shall be levelled and compacted to 90% SPMDD, 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 of the trench bedding for a width of one third of the pipe outside diameter, shall remain uncompacted.
 - (iii) A small groove shall be left at the midpoint to facilitate the removal of the sling after the pipe has been laid. Another groove shall be provided at each joint to facilitate placing of the pipe bell. Both grooves shall be filled with compacted sand after placement of pipe and removal of the sling.
 - (iv) Sand bedding shall be placed to 50 millimetres above the haunch of the pipe and thoroughly compacted to 90% SPMDD, to provide adequate lateral support of the pipe wall. Sand initial backfill shall then be placed to a depth above the pipe to a depth of 200 millimetres above the top of the pipe, for the full trench width. The Contractor shall ensure that disturbance of the pipe or damage to the pipe coating does not occur during sand bedding and backfilling operations.
 - (v) 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.
 - (vi) Pipe shall be installed utilizing trench methods. Coring, augering or jacking methods shall not be undertaken without approval of the Contract Administrator.
 - (vii) The exposed end of the pipe shall be fully protected with an approved stopper to prevent foreign matter from entering the pipe. The interior of the pipe shall be kept free of all dirt, concrete or superfluous material as the Work proceeds.
- (b) Jointing
 - (i) Pipe shall be joined in accordance to manufacturer's instructions and accepted industry practice. Over-insertion of pipe joints shall not be permitted.
- (c) Connection to Chamber Piping
 - (i) For pipe connection to chamber piping, connections shall be made by means of steel sleeve typed coupling. Pipe coupling to be protected from corrosion by Denso tape system.

E15.3.4 Temporary AWWA C905 PVC Pipe and Fittings

- (a) Temporary AWWA 905 PVC pipe used for the Haney Feedermain by-pass shall be either abandoned with flowable fill or removed and returned to the City after completion of the final tie-in of the Haney Feedermain.
- (b) Temporary AWWA 905 PVC fittings used for the Haney Feedermain by-pass shall be removed and returned to the City after completion of the final tie-in of the Haney Feedermain.

E15.3.5 Frost Conditions

- (a) No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when the Contract Administrator shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation. Every precaution

must be taken to prevent frost from penetrating the ground to depths below the foundations during construction. Any pipe which, in the opinion of the Contract Administrator, shall have been injured through neglect of this provision of the specifications, shall be removed and made good by the Contractor and at the Contractor's expense.

- (b) Heating of the pipe, sand, mortar and gaskets shall commence when the ambient temperature falls below -5 C. The pipe shall be heated throughout with a low heat immediately prior to installation (warm to the touch).
- (c) All mortar for joints shall be heated, and heated sand shall be placed around the pipe for the full height of the specified bedding and initial backfill and to at least 600 millimetres on either side of the joint, all to the satisfaction of the Contract Administrator.

E15.3.6 Thrust Blocks

- (a) Thrust blocks shall be installed at all tees, wyes, elbows, bends, plugs, reducers and crosses and at location shown on the Drawings. Thrust blocks shall consist of concrete as specified in Specification CW2160 and shall be installed as shown on the Drawings. The thrust block shall bear against undisturbed soil and the soil shall be cut smooth and at the proper angle to the pipe. No horizontal struts or braces required for trench bracing shall remain in the concrete thrust block. A bond breaker consisting of 0.20 millimetre (8 mil) polyethylene sheeting shall be installed between fittings, valves or plugs and the concrete of the thrust block to allow future removal of the thrust block without disturbing the fitting, valve or plug. Before any concrete is placed, all thrust block formwork shall be inspected and approved by the Contract Administrator.

E15.3.7 Clay Dikes

- (a) Clay dikes shall be constructed every 200 linear metres, 5 metres on each side of offtake/valve chamber walls, and as directed by the Contract Administrator. Clay dikes shall consist of compacted clay material extending the width of the trench and for a length of 600 millimetres and shall extend from the bottom of the sand bedding, i.e. from undisturbed earth to the top of the sand backfill.

E15.3.8 Connections to Existing Pipes

- (a) Connections to existing pipes shall be made at the locations shown on the Drawings.
- (b) Connections between existing prestressed concrete cylinder pipe and new Prestressed concrete cylinder pipe shall be made by means of bell and spigot joint. The Contractor shall provide a new pipe gasket for this connection.
- (c) Connections between existing prestressed concrete cylinder pipe and AWWA C905 PVC pipe shall be made by means of a bell or spigot plain end adaptor and bolted sleeve coupling as indicated on the drawings. Alternate connection methods for connection of PVC pipe to existing PCCP may be permitted upon review of the Contract Administrator. Design and fabrication of alternate connections will be the responsibility of the Contractor.
- (d) All non-tested pipe joints included in connection sections shall be exposed after recommissioning to inspect for leakage.

E15.3.9 Painting

- (a) All exposed metal surfaces including valves, fittings, anchor bolts, flange bolts etc. where not specified to be copper, brass or galvanized, and all galvanized surfaces exposed by welding connections shall be painted.
- (b) Metal surfaces shall be cleaned thoroughly by wire brushing or abrasive blasting.
- (c) Paint exposed surfaces in accordance to AWWA C213.

E15.3.10 Change in the Laying Schedule

- (a) If the Contractor requests changes in the laying schedule, that is relocation of items such as offtakes, closures, valve chambers or any other alteration of the laying schedule, all costs associated with these changes shall be paid for by the Contractor.

E15.3.11 Demolition, Removal and Abandonment of Existing Pipe and Fittings

- (a) Where indicated on the Drawings and directed by the Contract Administrator, remove designated portions of pipe. Removal methods shall be employed that preclude damage to adjacent pipes and joints that are to remain in place.
- (b) Salvage a minimum of one (1) complete length of each type of pipe and return to designated City facility for examination and testing purposes.
- (c) Piping required to be cut and/or demolished to facilitate removal of adjacent pipe shall be a minimum of one complete pipe length away from proposed connection points.
- (d) All gaskets from existing pipes shall be carefully salvaged, cleaned and inspected. Due to changes in gasket design, existing gaskets may require re-use when connecting to existing pipe spigots.
- (e) All pipe and valves removed shall be salvaged, and returned to a designated City of Winnipeg facility.
- (f) Abandon pipes with flowable fill where indicated on the Drawings. Flowable fill shall meet requirements of CW 2160.

E15.4 Quality Control

E15.4.1 Inspection

- (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.

E15.4.2 Line and Grade

- (a) The pipe shall be installed to the line and grade shown on the Drawings and as set in the field by the Contract Administrator. Vertical variance from grade shall not exceed 25 millimetres and horizontal variance from line shall not exceed 100 millimetres. Sharp bends will not be permitted even though the pipe remains within these tolerances. Alignment corrections allowed in main line piping but not at closures. Tees and bends shall be installed to the grades and at the locations shown on the Drawings or where required to connect to existing pipelines.

E15.4.3 Hydrostatic Leakage Testing

- (a) Testing shall be completed in accordance to CW 2125. The Contractor shall slowly fill the feedermain with potable water and ensure all air is expelled from the line.

E15.4.4 Disinfection of Watermains

- (a) Disinfection of watermains and feeder mains shall be completed in accordance with CW2125 except initial flushing will not be required.
- (b) The Contractor shall take every reasonable precaution during construction to prevent debris from entering the pipeline. If, in the opinion of the Contract Administrator, deleterious substances have entered the pipeline, the Contractor shall flush the pipeline with sanitized pipeline cleaning equipment.
- (c) Further to CW 2125, disinfection of segments of watermains not disinfected as noted above, shall be completed by swabbing as outlined in Section 3.3.16 of CW 2125.

- (d) Upon completion of disinfection, chlorinated water shall be pumped from the pipeline at the lowest point(s) in the system. Chlorinated water shall not be directly discharged to the environment. Chlorinated water shall be treated by one of the following methods, as recommended in AWWARF - GUIDANCE MANUAL FOR THE DISPOSAL OF CHLORINATED WATER:
 - (i) discharged into a waste water sewer;
 - (ii) be de-chlorinated using Sodium Ascorbate, Vita-D-Chlor™ by Integra Chemical, or approved equal in accordance with B7;
 - (iii) contained on Site until chlorine has dissipated to acceptable limits.
- (e) The pipeline shall be refilled with potable water and water samples for health tests taken in accordance to CW 2125, except test samples shall be taken each day at least 24 hours apart for three (3) successive days.

E15.5 Method of Measurement and Basis of Payment

E15.5.1 Supply and Installation of Feeder mains

- (a) Supply and Installation of feeder mains shall be measured and paid on either a Lump Sum or linear meter basis as listed in the Form B Prices.
 - (i) For feeder mains measured and paid by the linear meter the length to be paid for shall be the total number of linear metres of pipe for each size, class, restraint type, type of backfill and method of installation acceptably installed and paid for at the Contract Unit Price per linear meter for "Supply and Install Feedermain Piping" as listed in the Form B Prices. Measurement shall be made horizontally, at grade, above the centreline of the pipe, through all fittings and appurtenances, as computed by measurements made by the Contract Administrator, include all accessories, appurtenances. The length measured and paid will be from the first pipe joint outside of the valve chambers, to the connection points on the existing feeder mains. Measurement will be from face of bell to face of bell.
 - (ii) For pipelines measured and paid as a lump sum payment shall be made at the Contract Lump Sum Unit Price per linear meter for "Supply and Install Feedermain Piping" as listed in the Form B Prices.
- (b) Price for the supply and installation of feeder main piping shall include supplying all materials and performing all Work as required by this Specification.
- (c) Payment for feeder mains will be made on the following payment schedule;
 - (i) Thirty percent (30%) payment upon delivery of pipe to the jobsite.
 - (ii) Ninety percent (90%) payment upon successful installation of the pipe.
 - (iii) One hundred percent (100%) payment upon successful testing, disinfection and recommissioning of the pipe.
- (d) All couplings and special adaptors required to transition from existing Prestressed Concrete Cylinder Pipe feeder mains to the supplied pipe material shall be considered incidental to the supply and installation of the feeder main piping, no separate measurement or payment will be made.
- (e) Removal or abandonment of temporary feeder main piping shall be considered incidental to the supply and installation of the temporary feeder main piping, no separate measurement or payment will be made.

E15.5.2 Installation of Temporary AWWA C905 PVC Fittings

- (a) Supply and Installation of temporary feeder main by-pass fittings shall be measured and paid on a unit basis for each type and size of fitting acceptably installed as listed in the Form B Prices and paid at the Contract Unit Price per linear meter for "Supply and Install Temporary AWWA C905 Fittings".
- (b) Removal of temporary by-pass fitting shall be considered incidental to the supply and installation of the temporary fittings, no separate measurement or payment will be made.

E15.5.3 Supply and Installation Pipe Couplings

- (a) Supply and Installation of pipe couplings for connection of feedermain piping to chamber piping as shown on the Drawings shall be measured and paid on a unit basis for each size of coupling acceptably installed as listed in the Form B Prices and paid at the Contract Unit Price per linear meter for "Supply and Install AWWA C219 Couplings".
- (b) Couplings required to connect new piping to existing feedermain shall be considered incidental to the Work and no separate measurement or payment will be made.

E15.5.4 Connection to Existing Pipes

- (a) Connections to existing pipes will be measured on a unit basis. The price paid for the connection shall be the total number of connections made acceptably made in accordance with this specification as listed in Form B Prices and paid for at the Contract Unit Price for "Connection to Existing Feedermain". The connection shall include all excavations, backfill, removal of existing pipes and bulkheads, patching of concrete where required and provision of new pipe gaskets. Where connections involve installing a tee in an existing line, the price for the connection shall include reconnection of both ends of the tee.

E15.5.5 Testing and Disinfection

- (a) Testing and Disinfection of feedermain shall be considered incidental to the supply installation of the feedermain piping, no separate measurement or payment will be made.

E15.5.6 Removal of Existing Feedermain

- (a) Removal of existing feedermain as required for installation of new feedermain piping shall be incidental to the supply installation of the feedermain piping, no separate measurement or payment will be made.

E15.5.7 Abandonment of Existing Feedermain with Flowable Fill

- (a) Abandonment of existing feedermain with flowable fill shall be measured on a volume basis. The volume to be paid for shall be the total number of cubic metres of flowable fill acceptably used to abandon feedermain and paid for at the Contract Unit Price for "Abandon Existing Feedermain with Flowable Fill".

E16. BUTTERFLY VALVES

E16.1 Description

- (a) This Specification shall cover the design, manufacture and installation of butterfly valves. This Specification is supplementary to and shall be read together with the latest revision of AWWA Standard C504, "Rubber Seated Butterfly Valves".

E16.2 Design Requirements

- (a) General
 - (i) Design, materials and construction of all valves shall conform to the latest version of AWWA Standard C504.
 - (ii) Further to AWWA C504, products and coatings in contact with potable water shall be certified as suitable for contact with drinking water by an accredited certification organization in accordance with ANSI/NSF 61 "Drinking Water System Components – Health Effects"
 - (iii) Design torques shall be calculated using procedures outlined in AWWA Manual of Water Supply Practices – Butterfly Valves: Torque, Headloss and Cavitation Analysis – M49.
 - (iv) All butterfly valves to be supplied under this Contract shall be designed and manufactured by a company having at least five (5) years prior experience in

manufacturing these types of products in the sizes and to the pressure ratings as those specified herein.

(b) Design Parameters

- (i) Service Potable Drinking Water
- (ii) Chemical Resistance 1 % Hypochlorite
- (iii) Installation Submerged Service
- (iv) Operating service -40°C to +70°C
- (v) Water Temperature Service 0°C to 20°C
- (vi) Normal System Operating Pressure 552 kPa (80 psi)
- (vii) Valve Test Pressure (2 times Operating) 2000 KPa (300 psi)
- (viii) Type of Body (All) Flanged Short Body
- (ix) Maximum Non-Shock Shut-Off Pressure (All) 1000 Kilopascals (150 psi)
- (x) Body (All) Cast Iron
- (xi) Headloss Maximum K value 0.5
- (xii) Valve torques and safety factors shall be based upon the design pressure of 700 Kilopascals (100 psi).
- (xiii) Maximum Velocity 4.88 metres per second (m/s)

NOMINAL PIPE SIZE (MM)	QUANTITY	ACTUATOR TYPE	VALVE CLASS	PRIMARY SERVICE FUNCTION
450	1	Manual	150B	Isolation (Open/Close)
600	1	Manual	150B	Isolation (Open/Close)
750	1	Manual	150B	Isolation (Open/Close)

E16.3 Materials

(a) General

- (i) Materials for butterfly valves shall meet or exceed the latest revision requirements of AWWA Standard C504 and shall meet or exceed the requirements of this Specification.
- (ii) Materials throughout shall be the best of their respective kinds. The equipment shall be designed for the very highest class of service, shall include the highest degree of strength, durability and reliability for continuous operation and for most convenient maintenance.
- (iii) Liberal factors of safety (minimum of fifty percent (50%) shall be used throughout especially for all parts subject to alternating stresses or shock.
- (iv) All joints shall be machined and all castings shall be spot-faced for nuts. All rods shall be finished. All mating faces shall be drilled and tapped, peened, or finished as subsequently specified.
- (v) The mechanical features of the equipment covered by these Specifications shall conform to the appropriate standards of the ASME.
- (vi) Threads on all screws, bolts, studs, and nuts shall be American Standard. Tapped holes in flanges shall be standard unified national threads of the coarse-thread series.

- (b) Stainless Steel Components
 - (i) All components specified in the latest revision of AWWA Standard C504 as stainless steel and the valve shaft, pins, clamps and retaining rings for the rubber seats shall be Type 304 stainless steel. No alternative materials will be accepted in this regard.
- (c) Workmanship
 - (i) All foundry and machine work shall be in accordance with the best modern practice for the class of work involved.
 - (ii) All parts shall conform accurately to the required dimensions and shall be free from injurious defects. All machine parts shall be made to template or gauge.
 - (iii) No repairs to metal such as welding, plugging, peening or stitching will be permitted. Any valve or actuator exhibiting such repairs will be rejected.
 - (iv) All joints shall be faced true and shall be watertight where subject to water pressure.
 - (v) The bolt holes of all cast iron flanges and flanged fittings shall be spot faced to the specified thickness of flange with a plus tolerance of 3 millimetres (1/8 inch).
 - (vi) All iron parts receiving bronze mounting shall be finished to fit. Such hand work shall be done in finishing as is required to produce a neat, workmanlike, well fitting, and smooth operating job throughout.
 - (vii) All parts of the same size and same make shall be interchangeable.
- (d) Ferrous Castings
 - (i) All castings shall be true to pattern, of workmanlike finish and of uniform fine grain quality and condition, free from blowholes, porosity, hard spots, shrinkage defects, cracks, or other injurious defects and shall be smooth and well cleaned before inspection. Castings shall be readily machinable. Castings shall not be repaired, plugged, or welded.
- (e) Valve Bodies
 - (i) Valve bodies shall be short body and constructed of either cast iron conforming to ASTM Standard A126, Class B or ASTM A48, Class 40; of ductile iron conforming to ASTM A536, Grade 65-45-12; or of alloy cast iron conforming to ASTM A436, Type 1 and 2, or ASTM A439, Type D-2 with a maximum lead content of 0.003 percent.
- (f) Valve Ends
 - (i) The ends of the valves shall be flanged and drilled to ANSI B16.1 standard for cast iron flanges, Class 125.
- (g) Valve Discs
 - (i) The design and materials of valve discs shall conform to the requirements of Section 4.5 of the latest revision of AWWA Standard C504.
 - (ii) Discs shall be offset to provide an uninterrupted 360 degree seating edge and shall be cast iron per ASTM A48, Class 40 or ductile iron per ASTM A536 (65-45-12).
 - (iii) The disc seating edge, if applicable, shall be solid type 316 stainless steel.
 - (iv) The disc shall be securely attached to the valve shaft using type 304 stainless steel taper fasteners.
 - (v) Disc structures containing hollow cavities are not acceptable.
- (h) Valve Shaft
 - (i) Valve shaft shall be constructed of type 304 stainless steel.
- (i) Valve Seats
 - (i) Valve seats shall be reinforced natural or synthetic rubber reinforced with high resiliency fabric inserts. The mating seat shall be of type 304 stainless steel. Seats shall be of a design that permits adjustment, removal or replacement of the seat at the site of the installation without removal of the valve from the line. Seats that are clamped or mechanically secured are preferred over epoxy retained seats.
 - (ii) Valve seats shall be manufactured from a solid mass rather than layers of rubber bonded together.

- (iii) Valves with a rubber seat mounted on the valve disc shall meet the following conditions:
 - a) The disc seats shall be offset from the centre line of the shafts so that the rubber seat forms a continuous uninterrupted ring.
 - b) An insert of stainless steel shall be provided in the body to provide a smooth seating surface for the rubber disc seat.
- (iv) Mechanically retained rubber seats shall be held in position on the disc or body by a segmented retaining ring secured by type 316 stainless steel nuts and bolts which by tightening will slightly deform the rubber seat to maintain proper contact with the seat face throughout the entire circumference.
- (j) Bearings
 - (i) Bearings in the valve body for shaft ends shall be of the sleeve type made of self-lubricating material such as Teflon filled acetal or approved equal in accordance with B7.
 - (ii) Each valve shall be equipped with one or two thrust bearings of corrosion resistant material on the shaft, outboard of the shaft seal or in the actuator housing.
- (k) Shaft Seals
 - (i) Shaft seals shall be designed for the use of standard split-V type packing, standard O-ring seals or pull down packing as described in Section 4.5.7 of the latest revision of AWWA Standard C504.
- (l) Bolts
 - (i) Bolts for butterfly valves shall be ASTM A307 grade B. Bolt size, type and diameter shall be in accordance to AWWA C207. Bolt length suitable for coupling AWWA C207 Class D flange.
- (m) Flange Gaskets
 - (i) 3mm, full faced, SBR rubber gaskets or neoprene in accordance with AWWA C207. Gaskets shall be one piece construction where possible. Segmented gaskets shall be constructed of a minimum number of segments and joints shall be of dovetailed construction, or other jointing methods approved by the Contract Administrator.
- (n) Painting and Coating
 - (i) Interior surfaces shall be coated with a protective system in accordance to AWWA Standard C550 – Protective Interior Coatings of Valves and Hydrants, which can be used in a potable water system.
 - (ii) Interior coatings shall comply with ANSI/NSF 61 “Drinking Water System Components – Health Effects”
 - (iii) Coating shall be two (2) or more layers (5 mils minimum each coat) Polyamide Epoxy, Amerlock 400, Tnemec Series 140F Pota-Pox Plus or approved equal in accordance with B7. Application as per manufacturer’s recommendations.
 - (iv) Coatings shall be holiday free as defined in Section 5.2.3 of AWWA Standard C550.
 - (v) Exterior surfaces shall be painted consistent with interior surfaces.
 - (vi) Surfaces shall be prepared to NACE SSPC-SP10- Near-White Metal Blast Cleaning
 - (vii) All machined surfaces shall be protected with an approved coating, prior to assembly to prevent rusting. Machined surfaces for valve seats shall have particular attention paid to, as this area if untreated, has proven to support "barnacle growth" which can prevent watertight closure of the valve.
- (o) Acceptable Products
 - (i) DeZurik
 - (ii) K-Flo 47 Series
 - (iii) Mueller
 - (iv) Pratt
 - (v) Rodney Hunt

- (vi) Val-Matic
- (vii) or approved equal in accordance with B7.

E16.4 Submittals

(a) Shop Drawings

- (i) Submit Shop Drawings in accordance to E5.
- (ii) Shop Drawings shall state all performance and design criteria.
- (iii) Allow one (1) calendar weeks in delivery schedule for review of Shop Drawings, commencing at the date of receipt by the Contract Administrator.
- (iv) At the time of submission, the Contractor shall inform the Contract Administrator in writing of any deviation in the Shop Drawings from the requirements of the Contract Documents. The Shop Drawings shall include a copy of the Specifications attached in Part E and marked by the Contractor as either in "compliance" or "deviation" with comment.
- (v) Provide valve torque calculations for operating conditions listed.

(b) Affidavit of Compliance

- (i) Provide Affidavit of Compliance stating that valves meet requirements of the latest revision of ANSI/AWWA Standard C504 and terms of this specification.

(c) Testing

- (i) Provide all factory pressure test reports.
- (ii) Provide protective coating thickness measurements as specified in ANSI/AWWA Standard C550.
- (iii) Provide recent coating qualification testing results as specified in ANSI/AWWA Standard C550 Section 5.2.1.

E16.5 Valve Testing and Acceptance

E16.5.1 Factory Tests

(a) General

- (i) All acceptance testing shall be completed in the presence of the Contract Administrator or his appointed representative, unless the Contract Administrator waives this requirement. Provide a minimum of two (2) weeks notice of testing schedule to the Contract Administrator.
- (ii) Testing of valves and actuators, including pressure tests, paint and coatings and electrical tests shall be coordinated to minimize number of plant visits.
- (iii) If the Contract Administrator waives witnessing of testing as indicated in E16.5.1(a)(i), provide all testing results to the Contract Administrator for review prior to shipping valves.

(b) Butterfly Valves

- (i) All valves shall be tested with mated actuators mounted and adjusted.
- (ii) All valves shall be tested with valves mounted in the vertical operating orientation.
- (iii) Each valve shall be subjected to hydrostatic tests under a pressure (1000 kPa for class 150B valves) by the manufacturer at their facilities prior to shipping. The tests shall be conducted in the following manner, in accordance with the latest revision of AWWA Standard C504.
 - ◆ A hydrostatic pressure of (1000 kPa for class 150B valves) shall be applied through bulkheads, alternately to the two sides of the closed disc with the opposite side open to inspection. Under this pressure, the valve seat shall be perfectly watertight.
 - ◆ A hydrostatic pressure of (2000 kPa for class 150B valves) shall be applied to the body of the valve with bulkheads closing both flanges and the disc open. Under this pressure there shall be no leakage through the

metal or joints, no permanent deformation of the castings, and no other defects.

(iv) The following information shall be supplied by the Contractor prior to delivery of the valves:

- ◆ A certified copy of the chemical and physical analysis on all materials used in the manufacturer of the valve(s) or certification that the materials used are in strict accordance with this specification.
- ◆ Copies of the test reports for Performance, Leakage and Hydrostatic Tests performed in accordance with AWWA Standard C504. Included in the report shall be the signature of the official who is responsible for the valve assembly and testing.

(c) Protective Coatings

- (i) Conduct non-destructive film thickness testing, in accordance to NACE SSPC PA 2, on both interior and exterior surfaces and provide comparison to qualification standard, as per AWWA Standard C550.
- (ii) Conduct low voltage holiday testing as specified in AWWA Standard C550 section 5.2.3. Completed coating shall be holiday-free.
- (iii) The Contract Administrator will conduct holiday testing to NACE RP01188-88.
- (iv) The Contract Administrator will conduct disbondment testing in accordance to ASTM D 4541. Tensile adhesion shall be acceptable if a minimum tensile adhesion rating of 3447 kPa (500 psi) is achieved.

E16.5.2 Field Tests

(a) Butterfly Valves

- (i) The Contractor shall perform a hydrostatic leak test, in the presence of the Contract Administrator, on all valves once they arrive at the City warehouse.
- (ii) The City will provide a suitable blind flange for testing.
- (iii) The Contractor shall provide 3 millimetre SBR gasket, bolts, and testing equipment, suitable to conduct tests.
- (iv) The test shall be performed as follows:
 - ◆ The valve shall be orientated in the vertical position.
 - ◆ A gasketed, steel blind flange with a tapped fitting suitable for introduction of compressed water shall be bolted in place.
 - ◆ The space between the blind flange and valve disc shall be filled through the center port, and air bled off through the top port. Once all air has been expelled, the top test port shall be closed.
 - ◆ A pressure of 1000 kPa for class 150B valves shall be applied through the fitting and maintained for 10 minutes. Under this pressure the valve seat shall be perfectly watertight.
 - ◆ The test shall be repeated for the opposite side.

E16.5.3 The Contractor shall ensure a qualified representative of the valve manufacturer is present for the testing of the valves to correct any deficiencies found.

E16.6 Installation

E16.6.1 Installation of Butterfly Valve

- (a) Install butterfly valves as shown on the Drawings. Valves shall be installed with the valve shaft in the horizontal position.
- (b) Core 125 mm opening in roof slabs directly above actuator operation nut. Valve box and valve stem extensions shall be installed plumb and aligned directly above the valve actuator operation nut.

E16.6.2 Commissioning of Butterfly Valve

- (a) The Contractor shall assist in operation of the butterfly valve for the purpose of commissioning.

E16.7 Measurement and Payment

- (a) Supply and installation of butterfly valves shall be measured on a unit basis for each size of valve acceptably installed. Payment shall include supply and installation of valves, gearboxes, handwheels, extension shafts and any associated materials and work required for the installation. Payment will be made at the Contract Price for "Supply and Installation of Butterfly Valves".
- (b) Payment for butterfly valves will be made on the following payment schedule;
 - (i) Thirty percent (30%) payment upon delivery of valve to the jobsite and successful testing.
 - (ii) Ninety percent (90%) payment upon successful installation of the valve, and manual gear box.
 - (iii) One hundred percent (100%) payment upon successful testing, and commissioning of the valve.

E17. MANUAL VALVE ACTUATORS

E17.1 Description

- (a) This Specification shall cover the design and manufacture of manual actuators for butterfly valves to be supplied under this Contract. This Specification is supplementary to and shall be read together with the latest revision of AWWA Standard C504, "Rubber-Seated Butterfly Valves".

E17.2 General Design Requirements

- (a) Quarter turn, manual geared actuators shall be of worm gear drive type designed for one person operation and for a maximum pull on the handwheel rim, at maximum torque conditions of not more than 356 Newtons (80 ft pounds).
- (b) All manual actuators to be supplied under this Contract shall be designed and manufactured by a company having at least five (5) years prior experience in manufacturing these types of products in the size and to the pressure ratings as those specified herein.

E17.3 Gearing and Enclosure

- (a) Actuators shall be manual geared with a ball bearing mounted worm gear drive, machine cut gear teeth, and be totally enclosed in a sealed housing sufficient to permit normal operation even when totally submerged in water. Travelling nut type of mechanisms will not be accepted. Gear lubricant shall be of the bulk grease type; synthetic lubricants will not be accepted.
- (b) Number of actuator turns to open or close the valve shall be kept to as few as possible to avoid overtorquing and damage to the actuator.
- (c) Submersible rating shall be adequate for 7.5 metres water submergence for forty-eight hours.
- (d) Accessible parts of the actuator requiring lubrication shall be provided with button-head alemite grease fittings.

E17.4 Input Limit Stops

- (a) 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.
- (b) 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.

- (c) 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.

E17.5 Handwheel

- (a) 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 operating nut shall be 49 millimetres square at the top, 51 millimetres square at the base and 45 millimetres high. 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. Spinners shall be provided on all handwheels.
- (b) 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.

E17.6 Valve Position Indicator

- (a) A mechanical, valve position indicator shall be provided and mounted on the outside of each valve actuator. The dial or scale plate shall be 316 stainless steel and shall be clearly graduated and marked. A 316 stainless steel pointer shall be aligned to show the exact position of the valve disc in the valve body. The fastener for the indicator dial shall be made of 316SS stainless steel.
- (b) There shall also be a visible indication on the valve shaft end showing the position of the valve disc in relation to the shaft to ensure proper relation of the disc and indicating mechanism in the event an actuator has to be removed and replaced on a valve.

E17.7 Stainless Steel Extension Shaft

- (a) A 50 mm diameter stainless steel extension shaft shall be supplied with the butterfly valves 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 located a minimum of 150 mm and maximum of 450 mm from the proposed final grade.

E17.8 Protective Coatings

- (a) All external ferrous components including adaptor and mounting plates, shall be painted and tested in accordance to Clause E16.3(n) Painting and Coating and Clause E16.5.1(c) of this Specification.
- (b) 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 specifications used in the above clauses and shall be supplied by the Contractor. The Contractor shall provide a minimum of one (1) litre of paint product for this purpose.

E17.9 Acceptable Manufacturers

- (a) Rotork
- (b) Limitorque
- (c) or approved equal in accordance with B7.

E17.10 Measurement and Payment

- (a) Measurement and payment for manual actuators will not be made. The cost of the actuators shall be included in the price for the "Supply and Installation of Butterfly Valves" as listed in Form B: Prices.

E18. CHAMBER PIPING

E18.1 Description

- (a) This Specification shall cover the supply and installation of feedermain piping and appurtenances installed within the proposed valve chamber.

E18.2 Materials

E18.2.1 Bolts

- (a) Bolts for chamber piping shall be ASTM A307 grade B. Bolt size, type and diameter shall be in accordance to AWWA C207. Bolt length suitable for coupling AWWA C207 Class D flange.
- (b) Anti-seize compound shall be used on all bolts.

E18.2.2 Flange Gaskets

- (a) 3mm, full faced, SBR rubber gaskets or neoprene in accordance with AWWA C207. Gaskets shall be one piece construction where possible. Segmented gaskets shall be constructed of a minimum number of segments and joints shall be of dovetailed construction, or other jointing methods approved by the Contract Administrator.

E18.2.3 Chamber Pipe

- (a) Ductile Iron Pipe conforming to AWWA C151
 - (i) Class 54
 - (ii) Cement Lined as per AWWA C104
- (b) Steel Pipe conforming to AWWA C200 may be used may be used as an alternative. Steel pipe must meet the following:
 - (i) Minimum steel yield strength of 307 MPa (30,000 psi)
 - (ii) Minimum wall thickness 6.3 millimetres (600 and 300 millimetre size)
 - (iii) Paint for exposed steel surfaces shall be in accordance with AWWA C213.
 - (iv) Interior coatings shall comply with ANSI/NSF 61 "Drinking Water System Components – Heath Effects"
 - (v) Coating shall be two (2) or more layers (5 mils minimum each coat) Polyamide Epoxy, Amerlock 400, Tnemec Series 140F Pota-Pox Plus or approved equal in accordance with B7.

E18.2.4 Chamber Fittings

- (a) Flanged Ductile Iron Fittings
 - (i) Ductile Fittings conforming to AWWA C110
- (b) Fabricated steel fittings manufactured to AWWA C200 may be used as an alternative. Steel fittings must meet the following:
 - (i) Minimum wall thicknesses of 12.7 millimetres.
 - (ii) Minimum steel yield strength of 307 MPa (30,000 psi)

E18.2.5 Blind Flanges

- (a) Steel flanges shall be AWWA C207 Class D.
- (b) Cast and ductile flanges shall be ASME/ANSI B16.1 Class 125
- (c) Blind flanges to be fusion bonded epoxy coated to AWWA C213, and must conform to NSF 61.

E18.2.6 Wall Thrust Restraint

- (a) Ductile Iron Wall Thrust Restraints
 - (i) Mid span ductile iron thrust restraints shall be used to anchor the ductile iron wall pieces into the concrete chamber walls.

- (ii) Restraints must be able to provide full thrust restraint for the diameter of the pipe and must be designed for installation in concrete.
 - (iii) Approved product: Series 1100SDB manufactured by EBA Iron Inc. or approved equal in accordance with B7.
 - (b) Fabricated steel wall fittings shall be manufactured with a minimum 12 mm thick by 150 mm wide steel thrust ring, located at the midpoint of the chamber walls, of adequate design to resist specified design forces.
- E18.2.7 Flanges for chamber pipe and fittings shall conform to AWWA C207, minimum Class D Flange.
- E18.2.8 Restrained Dismantling Joints must conform to the following:
 - (a) End ring and body constructed from ASTM A36 steel
 - (b) AWWA C207, Class D Flanges
 - (c) NBR gasket conforming to ASTM D 2000.
 - (d) Stainless steel, type 316 Tie Rods
 - (e) Fusion bonded epoxy coating conforming to AWWA 213, must be NSF 61 certified.
 - (f) Approved product: DJ400 Series Dismantling joint as manufactured by Robar Industries Ltd. or approved equal in accordance with B7.
- E18.2.9 Small Diameter Ball Valves
 - (a) Small diameter threaded ball valves (50 mm diameter) shall be all cast bronze two-piece type with chromium plated ball complete with lever handle rated for minimum 1.0 MPa non-shock cold water service. Bronze material shall conform to ASTM B62. Acceptable product: Apollo, Red-White or approved equal in accordance with B7.
 - (b) Small diameter flanged ball valves (75 mm diameter) shall be ductile valves complete with Stainless Steel ball, ASME B16.1 CLASS 125 flanges and stem, Kitz #90 , Series 4000D as manufactured by American Valve Inc. or approved equal in accordance with B7.
- E18.2.10 Small Diameter Threaded Piping, Fittings and Flanges
 - (a) Small diameter brass threaded piping, fittings and flanges shall be cast red brass conforming to ASTM B43 or cast bronze conforming to ASTM B62. Flange dimension and drilling shall be in accordance with ANSI B16.24 - 150#.
 - (b) Small Diameter steel threaded fittings and flanges (75mm diameter and less) shall be in accordance with ANSI B16.5 - Class 150.
 - (c) Small diameter steel pipe nipples shall be Schedule 80 steel.
- E18.2.11 Flange insulator kits shall be Advance Products and Systems including full faced gasket, hole sleeves and washers, or approved equal in accordance with B7.
- E18.2.12 Paint
 - (a) Paint for exposed metal surfaces shall meet requirements of AWWA C210.
 - (b) Paint to be NSF 61 certified.
 - (c) Where used for closures internal linings shall be two (2) or more layers (5 mils dry film thickness minimum each coat) with a 100% solids liquid Epoxy, Enviroline 230, Bar-Rust 234P, Specialty Polymer Coatings SP-7888, or approved equal in accordance with B7.
 - (d) Coating for all exposed steel piping valves, and actuators shall be two (2) or more layers (5 mils dry film thickness minimum each coat) Polyamide Epoxy, Enviroline 230, Bar-Rust 234P, Specialty Polymer Coatings SP-7888, Tnemec Series 140F Pota-Pox Plus, Amerlock 2 or approved equal in accordance with B7.

E18.3 Installation

E18.3.1 Ductile Iron Thrust Restraint Flanges

- (a) Install as per manufactures recommendations
- (b) Flanges must be wrapped in a polyethylene wrap to prevent intrusion of concrete into the locking mechanism.
- (c) 2 flanges required per wall fitting. Flanges must be installed in opposite directions to provide unidirectional thrust restraint.

E18.3.2 Restrained Dismantling Joints

- (a) Install as per manufactures recommendations

E18.3.3 Threaded Valves, Fittings, and Blind Flanges

- (a) Install threaded nipples and flanges where indicated. Wrap all threads with a minimum of two wraps of Teflon tape or "pipe dope" containing Teflon. Isolate dissimilar metal flanges with gaskets, insulating bolt sleeves and non-metallic washers.

E18.3.4 Painting

- (a) Where required, prepare metal surfaces for recoating by blast cleaning to near-white metal as specified by Joint Surface Preparation Standard NACE No.2/SSPC-SP10. Remove all dust and loose residues from the prepared surfaces and chamber floor. The surface shall be roughened to a degree suitable for the coating system employed.
- (b) Protect valve seals, machined surfaces, threads, and nameplates from sandblasting.
- (c) Paint prepared surfaces in accordance to AWWA C210.
- (d) Primer coat to follow immediately after completion of sandblasting and prep.
- (e) Provide adequate ventilation and heat to facilitate curing of coatings.
- (f) Where used for pipe closures, pipe and fitting interior linings shall be applied and cured in conditions suitable to attain complete cure suitable for water immersion within 36 hrs.

E18.4 Measurement and Payment

E18.4.1 Chamber Piping and Fittings

- (a) Supply and installation of chamber piping and fittings shall be measured and paid on a unit basis for each fitting type acceptable installed as listed in the Form B Prices. Payment shall be made at the Contract Price for "Supply and Install Chamber Fittings".
- (b) The payment for the supply and installation chamber fittings shall include all bolts, gaskets, and other materials and work as required to complete the Work as specified herein.

E18.4.2 Restrained Dismantling Joints

- (a) Supply and installation of restrained dismantling joints shall be measured and paid on a unit basis for each size acceptable installed as listed in the Form B Prices. Payment shall be made at the Contract Price for "Supply and Install Restrained Dismantling Joints".
- (b) The payment for the supply and installation of restrained dismantling joints shall include all bolts, gaskets, and other materials and work as required to complete the Work as specified herein.

E18.4.3 Small Diameter Chamber Piping

- (a) Supply and installation of small diameter chamber piping and valves shall be measured and paid on lump sum basis. Payment shall be made at the Contract Price for "Small Diameter Chamber Piping".

- (b) The payment for the supply and installation of small diameter chamber piping shall include all drain and air blow off piping, flanges, gaskets, valves, and other materials and work as required to complete the Work as specified herein.

E18.4.4 Wall Thrust Restraints

- (a) Ductile iron wall thrust restraints shall be considered incidental to the supply and installation of the chamber wall fittings and no separate measurement or payment will be made.

E18.4.5 Blind Flanges

- (a) Blind flanges shall be considered incidental to the supply and installation of the chamber fittings and no separate measurement or payment will be made.

E19. CONSTRUCTION OF VALVE CHAMBER

E19.1 Description

- (a) This Specification shall cover the construction of a new reinforced concrete valve chamber as shown on the Drawings.

E19.2 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.

E19.2.1 Concrete

- (a) Concrete mix design shall be as indicated in the Construction Notes on the Drawings and in accordance with CW 2160 and E22.

E19.2.2 Reinforcing Steel

- (a) Reinforcing Steel shall conform to CW 2160 and E23.

E19.2.3 Metal Fabrications

- (a) Metal Fabrications shall conform to E21.

E19.2.4 Shop Drawings

- (a) Provide shop drawings in accordance with E4.

E19.2.5 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 approved by the Contract Administrator.

E19.2.6 Foundation Waterproofing

- (a) Foundation waterproofing shall conform to CW 2160.

E19.2.7 Valve Box Sealant

- (a) Sealant for the valve box flange shall be a general purpose butyl sealant rated for buried and exterior locations.

E19.2.8 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.

E19.2.9 Rigid Insulation

- (a) High Strength Rigid insulation for below grade: to CAN/ULC S701, Type 4, Styrofoam HI 40 by Dow Chemical, Foamular 400 by Owens Corning, or approved equal in accordance with B7.
- (b) Thickness as indicated on Drawings.

E19.2.10 Protection Board

- (a) 19 millimetre pressure treated plywood intended for bellow grade applications.

E19.3 Construction Methods

E19.3.1 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.

E19.3.2 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 approved by the Contract Administrator and in no case before field cured test cylinders show the concrete strength to be 75% of that specified.

E19.3.3 Grout

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

E19.3.4 Installation of Removable Roof Slabs

- (a) Clean joint surfaces as per sealant manufacturer's instructions.
- (b) Install removable roof slabs.
- (c) Apply joint filler as per manufacturer's instructions.

E19.3.5 Insulation

- (a) Clean surfaces to receive insulation. Place insulation as indicated on Drawings. Ensure joints between boards are tight. Stager joints where possible.
- (a) Cover horizontal surfaces with protection board and 100 millimetres of sand as shown on the Drawings.

E19.4 Measurement and Payment

- (a) Construction of the valve chamber will be measured on a Lump Sum Basis and paid at the Contract Price for "Construction of Valve Chamber" which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E20. CHAMBER DRAIN

E20.1 Description

- (a) This Specification shall cover the construction of the valve chamber sump and sump drain as shown on the Drawings.

E20.2 Materials

E20.2.1 Piping

- (a) PVC solid wall and perforated drain pipe and fittings shall conform to CSA B182.1 and B182.2.
- (b) Drain piping within the chamber shall utilize a solvent weld joint type.
- (c) Perimeter drain piping shall utilize an elastomeric gasketed joint.
- (d) Piping conforming to CSA 182.2 shall have a dimension ratio of 35.

E20.2.2 FRP Grating

- (a) H-20 load carrying capacity.
- (b) Acceptable Products: Fibergrate molded grading, or approved equal in accordance with B7.

E20.3 Installation

- (a) Install sump drain, perimeter drain, trap, cleanout, and grating as indicated on the Drawings.

E20.4 Measurement and Payment

E20.4.1 Drain Piping

- (a) Supply and installation of the chamber sump and perimeter drain piping and fittings up to 1 m from the building will not be measured for payment. It is to be included in the price for "Construction of Valve Chamber".
- (b) Supply and installation of the chamber sump drain beyond 1 m from the building shall be measured and paid on lump sum basis. Payment shall be made at the Contract Price for "Supply and Install Chamber Drain". The payment for the supply and installation of the chamber drain line shall include all piping, fittings, and other materials and work as required to complete the Work as specified herein.

E20.4.2 FRP Grating

- (a) Supply and installation of the chamber sump grating will not be measured for payment. It is to be included in the price for "Construction of Valve Chamber".

E21. METAL FABRICATIONS

E21.1 Description

- (a) This Specification shall cover the construction of a new reinforced concrete valve chamber as shown on the Drawings.

E21.2 General

- (a) Design Code and Quality Assurance
 - (i) Perform welding in accordance with requirements of CSA W59.
 - (ii) Welding work on all load carrying structures and assemblies is to be performed by a firm certified by the Canadian Welding Bureau to the requirements of CSA W47.1 in Division 2.
 - (iii) All welders employed to weld load carrying structures in the field are to possess valid "S" Classification Class "O" certificates issued by the Canadian Welding Bureau.

- (b) 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) Shop Drawings and design briefs are to bear the seal of a Professional Engineer registered in the Province of Manitoba.

E21.3 Materials

- (a) Miscellaneous Steel (angles, channels, plates): conforming to CAN/CSA-G40.21; Type W with minimum yield strength of 300 MPa.
- (b) Structural Steel Wide Flange Sections (W Shapes): conforming to CAN/CSA-640.21, grade 350W with minimum yield of 350 MPa, or conforming to ASTM A992 or A572, grade 50 with minimum yield of 345 MPa.
- (c) Hollow Structural Steel: conforming to CAN/CSA-G40.21, Grade 350W Class 'C' with minimum yield strength of 350 MPa. Hollow structural sections conforming to ASTM A 500 Grade C will not be acceptable unless accepted by the Contract Administrator.
- (d) Welding Materials: conforming to CSA W59.
- (e) Bolts conforming to ASTM A 325 and ANSI ASME B18.2.6 heavy hex class 2A; nuts conforming to ASTM A 563; and washers conforming to ASTM F 436; painted to match fastened items.
- (f) Concrete anchors: as manufactured by Hilti (Canada) Ltd. where indicated or approved equal in accordance with B7.
- (g) Finishes
 - (i) All metal fabrications to be galvanized.
 - (ii) Galvanizing for steel shapes: conforming to ASTM A 123/A 123M.
 - (iii) Galvanizing for steel fasteners: conforming to ASTM A 153/A 153M.
 - (iv) Clean all members receiving galvanizing material to SSPC SP-10 "near white blast cleaning".

E21.4 General Fabrication

- (a) All metal fabrications are to be galvanized with exposed finish unless noted otherwise.
- (b) Verify all dimensions on Site prior to shop fabrication.
- (c) Fabricate items of sizes and profiles detailed on Drawings, with joints neatly fitted and properly secured.
- (d) Fit and shop assemble in largest practical sections for delivery to Site.
- (e) Supply all components required for proper anchorage of steel fabrications. Fabricate anchorage and related components of same material and finish as steel fabrications, unless otherwise specified or shown.
- (f) Weld connections where possible, otherwise bolt connections. Cut off bolts flush with nuts.
- (g) Accurately form all connections and joints with exposed faces flush, mitres and joints tight.
- (h) Exposed welds and metal sections shall be smooth and flush; grind or file as required.
- (i) Top rail of guardrail and handrail galvanized finish shall be smooth; grind or file as required.
- (j) Provide for flush welded or hairline butt field joints.
- (k) Shop fabricate openings in members for other building components. Reinforce openings to restore member to original design strengths.

- (l) Provide lugs, clips, brackets, hangers and struts as required for attaching steel items securely to building structure.

E21.5 Installation

- (a) Obtain the Contract Administrator's permission prior to Site cutting or making adjustments that are not part of scheduled work.
- (b) Install items plumb, square, level and fitted accurately and maintain free from distortion or defects detrimental to appearance and performance.
- (c) Make provision for erection stresses and temporary bracing. Keep Work in alignment at all times.
- (d) Replace items damaged in course of installation.
- (e) Perform required field welding. Exposed welds shall be smooth and flush; grind or file as required.
- (f) Perform necessary cutting and altering for the installation of Work of other Sections, and as indicated on Drawings. No additional cutting is to be done without the permission of the Contract Administrator.
- (g) Perform all field assembly bolting and welding to match standard of shop bolting and welding. Bolts and screws are to be concealed whenever possible.
- (h) After installation, touch up field bolts, nuts, welds and scratched and damaged galvanized surfaces. Touch up galvanized surfaces with minimum two (2) coats of zinc rich primer.
- (i) Supply, to appropriate sections, items required to be cast into concrete, complete with necessary setting templates.

E21.6 Measurement and Payment

- (a) Supply and installation fabricated metal components shall be paid for under the Lump Sum Price for "Construction of Valve Chamber", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E22. CAST-IN-PLACE CONCRETE

E22.1 Description

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

E22.2 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) Bonding Agent
 - (i) Bonding agent shall be ACRYL-STIX or approved equal in accordance with B7.

- (d) Waterstop
 - (i) Waterstop shall be 152.4mm wide by 9.5mm thick Vinylex ribbed center bulb or approved equal in accordance with B7.

E22.3 Construction Methods

E22.3.1 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.
 - (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.

E22.4 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.
- (c) Install foundation waterproofing in accordance with Specification CW 2160.

E22.5 Measurement and Payment

- (a) Supply and placement of cast-in-place concrete shall be paid for under the Lump Sum Price for "Construction of Valve Chamber", which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the Work included in this Specification.

E23. REINFORCING STEEL

E23.1 Description

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

E23.2 Materials

E23.2.1 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.

E23.2.2 Bar Accessories

- (a) Bar accessories shall be of type approved by the Contract Administrator. They shall be made from a non-corroding material, and they shall not stain, blemish, or spall the concrete surface for the life of the concrete. Bar chairs are to be PVC; galvanized bar chairs are not acceptable.
- (b) Bar accessories shall include bar chairs, spacers, clips, wire ties, wire (18 gauge minimum), or other similar devices that may be approved by the Contract

Administrator. Bar accessories are not shown on the Contract Drawings. The supply and installation of bar accessories shall be considered incidental to the supply and placing of reinforcing steel.

E23.3 Construction Methods

E23.3.1 Placing of Reinforcing Steel

- (a) Reinforcing steel shall be placed accurately in the positions shown on the Contract Drawings. Carefully adjust the location of reinforcing steel adjacent to openings to frame those openings in accordance with good practice, and maintain the bar spacing intent.
- (b) Splices in reinforcing steel shall be made only where indicated on the Contract Drawings. Prior approval of the Contract Administrator shall be obtained where, in the opinion of the Contractor, other splices must be made. All splices shall have laps of at least 40 bar diameters. Welded splices shall not be used.
- (c) A minimum of twenty-four (24) hours notice shall be given to the Contract Administrator prior to the pouring of any concrete to allow for inspection of reinforcing steel.

E23.3.2 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.

E23.3.3 Shop Drawings

- (a) The Contractor shall submit shop drawings in accordance with E4 for the Contract Administrator's approval two (2) weeks prior to the fabrication of any reinforcing steel.

E23.4 Measurement and Payment

- (a) Supply and placement of reinforcing steel shall be paid for under the Lump Sum Price for "Construction of Valve Chamber", 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.

PART F - SECURITY CLEARANCE

F1. SECURITY CLEARANCE

- F1.1 Each individual proposed to perform the following portions of the Work:
- (a) any Work on private property;
 - (b) communicating with residents and homeowners in person or by telephone;
- F1.1.1 Each Individual shall be required to obtain a Criminal Record Search Certificate from the police service having jurisdiction at his/her place of residence. Or
- (a) BackCheck, forms to be completed can be found on the website at: <http://www.backcheck.net/> ; or
 - (b) Commissionaires (Manitoba Division), forms to be completed can be found on the website at: <http://www.commissionaires.mb.ca/> .
- F1.2 Prior to the commencement of any Work specified in F1.1, and during the term of the Contract if additional or replacement individuals are proposed to perform Work, the Contractor shall supply the Contract Administrator with a Criminal Record Search Certificate obtained not earlier than one (1) year prior to the Submission Deadline, or a certified true copy thereof, for each individual proposed to perform such Work.
- F1.3 Any individual for whom a Criminal Record Search Certificate is not provided, or for whom a Criminal Record Search Certificate indicates any convictions or pending charges related to property offences or crimes against another person will not be permitted to perform any Work specified in F1.1.
- F1.4 Any Criminal Record Search Certificate obtained thereby will be deemed valid for the duration of the Contract subject to a repeated records search as hereinafter specified.
- F1.5 Notwithstanding the foregoing, at any time during the term of the Contract, the City may, at its sole discretion and acting reasonably, require an updated criminal records search. Any individual who fails to provide a satisfactory Criminal Record Search Certificate as a result of a repeated criminal records search will not be permitted to continue to perform any Work specified in F1.1.

Appendix A

Geotechnical Technical Memo - Site Investigation

Memorandum

To	Marvin McDonald	Page	1
CC			
Subject	Eldridge and Haney Valve Chambers Upgrades		
From	Alex Hill		
Date	May 30, 2013	Project Number	60297251 (402.9)

1. Introduction

In association with the City of Winnipeg's renewal of the water distribution system at the intersection of Eldridge Avenue and Haney Street, geotechnical design recommendations are required to facilitate the upgrade of the various water components within the distribution system, specifically the buried valve chamber.

A geotechnical investigation was undertaken by AECOM as part of the design services scope of work. This report presents a summary of the subsurface investigation as part of the project's geotechnical requirements included within the design and construction of the proposed buried valve chamber.

2. Geotechnical Investigation

A geotechnical investigation was undertaken on April 26, 2013 by Maple Leaf Drilling Ltd. under the supervision of AECOM geotechnical personnel. The drilling program consisted of the completion of one (1) test hole (TH13-01) to a depth of 14.2 m below ground surface. The test hole was drilled using a track-mounted Acker Renegade drill rig equipped with a 125 mm solid stem continuous flight auger. The approximate location of the test hole is presented on the Test Hole Location Plan provided within Appendix A. Due to the proximity of nearby buried utilities (i.e., Forcemain and Hydro), the position of the test hole (TH13-01) was relocated approximately 4 - 5m north of the existing valve chamber as shown on the Test Hole Location Plan attached in Appendix A.

Disturbed samples from auger cuttings, Standard Penetration Tests (SPT) and relatively undisturbed samples (Shelby tubes) were collected at regular intervals for further visual inspection and testing.

Laboratory testing completed on selected samples including moisture content, unit weight, Atterberg limits, gradation, undrained shear strength, and consolidation. A record of the observed soil conditions and the relative position of the soil strata, location of samples obtained, field and laboratory test results, and other pertinent information have been compiled and presented as a formal test hole log. The test hole log is attached in Appendix B.

3. Subsurface Conditions

Sub-surface conditions can vary highly across a site and the information provided in this section is a summary of the findings from the field investigation and laboratory testing program.

In descending order, the general soil profile is as follows:

- Clay Fill
- Clayey Silt (Upper Complex)
- Silty Clay (Lacustrine Clay)
- Silt Till (Glacial Till)
- Sandy Silt (Amaranth Formation)

These soils are described as follows:

3.1 Clay Fill

Fill material was encountered directly below ground surface with an approximate thickness of 0.45 m as noted in the test hole log. The fill material comprised of highly plastic clay, trace sand and trace gravel.

3.2 Clayey Silt (Upper Complex)

A clayey silt deposit was noted directly beneath the clay fill which is considered to be representative of the Upper Complex, which has a corresponding thickness of approximately 0.45 m. The deposit consisted of low to intermediate plastic clayey silt with some sand. The clayey silt was greyish brown in colour, firm in consistency, and moist.

3.3 Clay (Lacustrine Clay)

Lacustrine clay was present beneath the clayey silt of the Upper Complex, with an observed thickness of 8.9 m based on test hole TH13-01. The Lacustrine clay was noted with some silt, dark brown to grey, moist and highly plastic. SPT testing was performed in the Lacustrine clay and indicated a soft to firm consistency which is generally consistent with other field test results (i.e., torvane and pocket penetrometer).

A summary of the results of the geotechnical tests performed on the Lacustrine clay samples is presented in Table 3-1 below.

Table 3-1: Geotechnical Laboratory and Field Results Summary - Lacustrine Clay

Test	No. of Tests	Result
Moisture Content (%)	7	23.5 - 55.6
Plasticity Index (%)	1	69.2
Dry Density (g/cm ³)	2	1.16- 1.26-
Bulk Density (g/cm ³)	2	1.76- 1.79-
Grading (Hydrometer)	1	Gravel: 0.0%, Sand: 0.0%, Silt: 12.2%,

Test	No. of Tests	Result
		Clay: 87.8%
Undrained Shear Strength (kPa)*	15	12.3 - 120.6
SPT 'N' Values	4	3 - 5
Consolidation (Oedometer)	1	See Appendix C

Notes: * Based on Torvane, Pocket Penetrometer and Unconfined Compressive Strength Testing

3.4 Silt Till (Glacial Till)

Glacial Till was encountered below the Lacustrine clay at a depth of 8.9 m at a corresponding elevation of 226.26 m (above sea level) with an approximate thickness of 1.45 m. The Glacial Till consisted of a low plastic sandy silt with trace clay and trace gravel. The till deposit was noted to be light grey in colour, compact and wet. The density of the till appeared relatively consistent with depth. A sample tested for moisture content returned a result of 11.6%.

3.5 Sand and Silt (Amaranth Formation)

The Amaranth Formation was noted directly beneath the Glacial Till to a depth of 14.2 m below ground surface. The thickness of the formation was not proven in drilling of the test hole (TH13-01). The encountered soils consisted of sandy silt with some clay, red in colour, very dense and moist. SPT testing performed on the sandy silt had recorded 'N' value results of between 56 and 100. Moisture content results ranged from 13.0 to 15.5 percent, with an average of 14.3 percent as shown in Table 3-2 below.

Table 3-2: Geotechnical Laboratory and Field Results Summary –Amaranth Formation

Test	No. of Tests	Result
Moisture Content (%)	2	13.0- 15.5
Grading (Hydrometer)	1	Gravel: 0.0%, Sand: 37.4%, Silt: 47.2%, Clay: 15.4%
SPT 'N' Values	2	56- 100

The Geological Engineering Report for Urban Development of Winnipeg (Dept. of Geological Engineering, University of Manitoba, 1983) states that the Amaranth Formation is likely to have a thickness of 30 m in the Charleswood area and consists of red beds of shale and sandstone.

4. Ground water and Sloughing Condition

Sloughing was encountered during drilling within the Lacustrine clay at a depth of 7.6 m below ground surface in test hole TH13-01. Seepage was also noted during drilling at a depth of 9.8 m below ground surface near the Glacial Till contact.

Groundwater conditions may vary seasonally, annually or due to construction activities.

5. Geotechnical Considerations and Recommendations

The following geotechnical recommendations relate to the design and construction of the proposed buried valve chamber at an approximate depth of 5 m below ground surface, and with an assumed width of 5 m. The depth of frost penetration is anticipated to be about 2.0 m below existing ground surface; therefore, the buried depth of the chamber is considered sufficient to resist frost jacking. Any proposed work with geotechnical requirements should be reviewed by this office to determine if the following recommendations apply.

5.1 Foundations

Based on the subsurface conditions identified at the site and understanding of the proposed structure, a raft (slab) foundation founded on the native lacustrine clay is considered the most suitable foundation system for the proposed buried valve chamber. For a raft foundation supported on the highly plastic lacustrine clay (at a depth of 5 m below current grade), a maximum allowable net bearing pressure of 75 kPa can be used in the design. At the time of report preparation, information regarding loading data was not available. However, assuming the proposed facilities would be lightly loaded (i.e., less than 75 kPa), the long-term total (immediate and consolidation) settlement is estimated to be less than 25 mm with typical differential settlements on the order of half of the total settlement.

Foundations placed at depths where the structural load equals the weight of the excavated soil usually have adequate bearing capacity and only recompression settlement. If the pressure from the structure on the foundation soil is in excess of the in-situ pressure, the settlement should be estimated. If the structural loading is less than the in-situ overburden pressure, then upward displacement and rebound at the foundation level is expected as a result of the stress relief due to excavation unloading. The rebound movement is expected to be partially restrained by the weight of the structure and the side friction along the walls and backfill. Theoretically, the rebound will continue up to a point where the stress at the foundation level is equal to the removal of overburden pressure before the excavation. In this regard, the base of the structure should also be designed to resist an upward pressure equal to the in-situ overburden pressure. Forces that can be considered in providing the uplift resistance include; the dead weight of the structure, side friction at the interface between soil/wall or soil/soil, and the weight of the soil above the footings. If needed, the footings of the structure can also be extended symmetrically beyond the walls of the structure at least 1.0 m so that the weight of the soil above can be accounted for uplift resistance.

Preparation of the bearing surface should include removal of all loosened and disturbed soils. Care should be taken to avoid excessive disturbance of the bearing surface during preparation. The bearing soil should be proof rolled or compacted to 95% of Standard Proctor Maximum Dry Density (SPMDD). Once the bearing surface has been suitably prepared, it should be evaluated by qualified geotechnical personnel from AECOM to confirm that the conditions are consistent with the geotechnical design assumptions and that proper construction practices are being employed. If soft areas are encountered at excavation level, the soft soil should be removed and replaced with granular fill. Where granular fill is used, it should be placed in maximum 150 mm lifts and uniformly compacted to a minimum of 100% SPMDD. A layer of lean mix concrete (mud slab) or a layer of crushed limestone at the base of excavation may be required to form a working surface prior to construction of foundation.

5.2 Retaining Walls

The lateral earth pressure transferred to walls of the structure (if the structure is not closed) will be a function of backfill material, method of placing and compacting backfill, and amount of horizontal deflection allowed by walls after backfill is placed. Assuming free draining backfill and walls that are not free to deflect, the at-rest earth pressure coefficient (K_o) of 0.55 should be used for design. For walls which are allowed to translate or deflect horizontally by at least 2% of retained height, an active earth pressure coefficient (K_a) of 0.33 can be used.

If needed, buried or partially buried walls or structural elements should be designed to resist at-rest lateral earth pressure derived on the basis of the following conventional relationship:

$$P = K_o * (\gamma D + q) \quad \text{Equation (1)}$$

Where:

- P = Lateral earth pressure at depth D (kPa)
- K_o = At-rest earth pressure coefficient = 0.55
- γ = Soil / backfill unit weight
- D = Depth from ground surface to point of pressure calculation (m)
- q = Surcharge load within distance D from the wall edge (kPa)

Below the groundwater level, the hydrostatic pressure must be added and the submerged weight of soil / backfill should be used.

It is recommended that the walls be backfilled with a free-draining granular soil with a maximum of 5 percent fines (maximum of 5 percent finer than #200 (0.075 mm) sieve). Cohesive soils are not recommended for backfill. Compaction of granular fill within approximately 1.5 m of the wall should be conducted with a hand-operated vibrating plate compactor. Over-compaction of the backfill adjacent to the wall may result in earth pressures that are considerably higher than those predicted in design.

6. Excavation Plan and Temporary Shoring

Temporary excavations up to a depth of 5 m will be required to facilitate the proposed construction. With time and the presence of seepage and/or precipitation, the stability of temporary cuts can be significantly reduced. Therefore, construction should proceed as rapidly as feasible to limit the time the excavations are left open. Runoff water should be prevented from entering excavations. Temporary work is the responsibility of the Contractor and all necessary measures should be undertaken to protect against adverse impact or undermining the foundation or stability of existing infrastructure/structures. All excavation should be completed in accordance with Manitoba's Occupational Health and Safety Regulation (OHS).

6.1 Unsupported Excavation

Open excavation can be used if available space allows. No surcharge should be allowed within a distance equal to the depth of the excavation from the excavation edge. Temporary unsupported excavations up to a depth of 2 m could be cut with back slopes not steeper than 1H:1V. Detailed stability assessment should be carried out for excavations greater than 2 m in depth or if they are to

remain open for an extended period of time. If soft zones or perched groundwater are encountered, flatter slopes may be required. Where a combination of open excavation and shoring is planned, the toe of the cut slope should be at least half the depth of the shored excavation from the shoring face. A perimeter ditch should be provided to intercept surface runoff and/or any groundwater from entering the excavation.

6.2 Lateral Pressure for Supported Excavation

In addition to open excavation, supported excavations will be necessary for the proposed buried valve chamber. Cantilever and braced shoring will be used to support the excavations. Cantilevered shoring is limited to depths of approximately 4 m, beyond this depth the shoring will generally have to be braced or tied back. The design is expected to include a soldier pile system or sheet piling. In this regard, the earth pressure distribution shown in Figure 1 should be used to design the shoring.

The design should account for all applicable surcharge loads. Shoring is usually designed to keep movements around the perimeter of the excavation within acceptable limits. Avoidance of ground movement entirely is not possible. The amount of movement that will occur cannot be accurately predicted mainly because the movements are more a function of excavation procedures and workmanship than they are of theoretical considerations.

Settlements of the ground surface adjacent to braced excavation are often estimated using the design chart developed by Peck (1969) as shown in Figure 2. It is recommended that the boundary between zone II and III be used to estimate vertical ground movements at the subject sites. It should be recognized that the predicted ground movements are associated with standard soldier piles and lagging or sheet piles with cross bracing or tie back anchors, assuming they are installed with a normal quality of workmanship. Good contact between the lagging and retained soil should be maintained throughout the construction period. Free draining sand should be used to fill the voids behind the lagging or sheet piles.

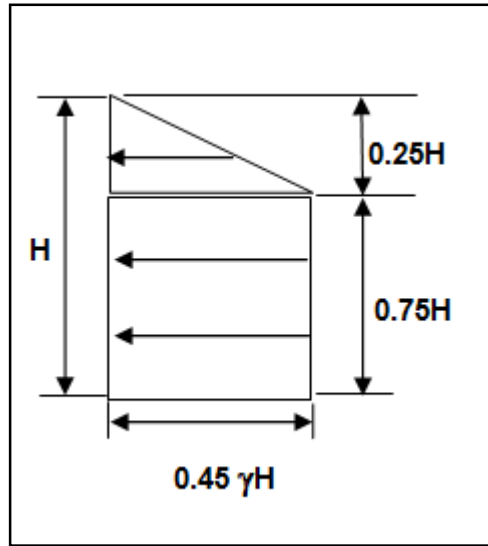


Figure 1: Earth Pressure Distribution for Shored Excavation

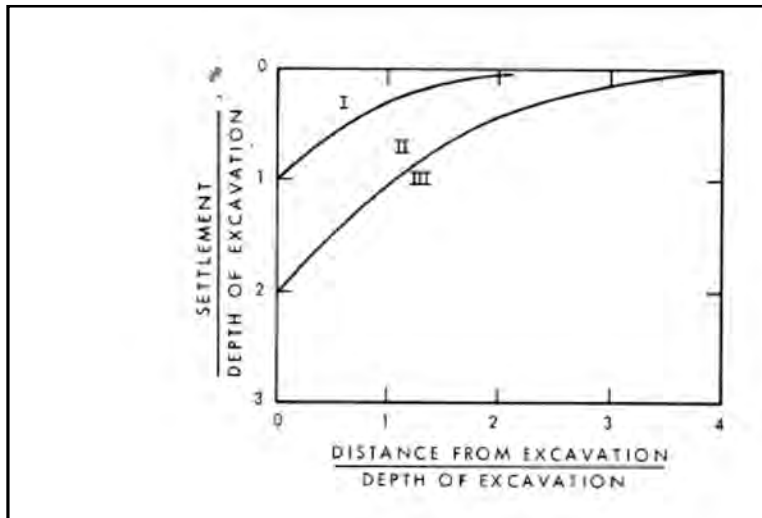


Figure 2: Ground Settlement Estimate Adjacent to Excavation

7. Closing

The engineering design recommendations presented within this memorandum are based on the assumption that an adequate level of geotechnical monitoring will be provided during construction and that qualified contractors experienced in foundations and excavations will carry out the construction. An adequate level of geotechnical monitoring is considered to be regular monitoring of construction procedures and compaction testing for earthworks.

If the conditions encountered during construction are different from the conditions reported in this memorandum or the conditions upon which the recommendations in this report are made, our office shall be contacted so that our recommendations can be reviewed and modified, if required.

Should you require any further assistance, please do not hesitate to contact the undersigned.

Respectfully submitted,

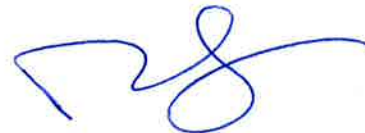


Alex Hill, B.Sc. FGS
Geotechnical Engineering

Reviewed by:



Zeyad Shukri, M.Sc.
Senior Geotechnical Engineer

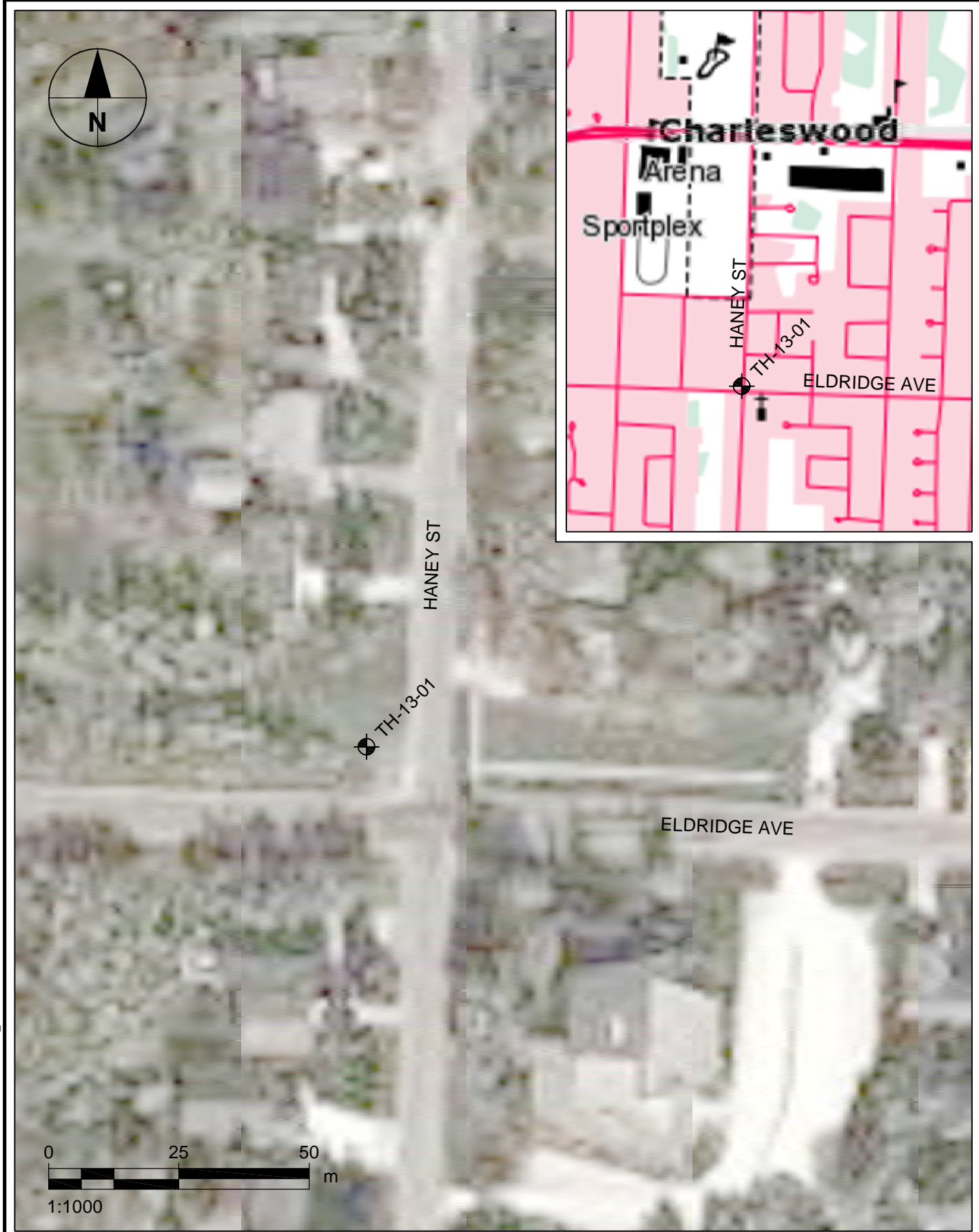


Patrick Chang, P.E., P.Eng
Senior Project Engineer



Appendix A

Test Hole Location Plan



AECOM

Appendix B

Test Hole Logs

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

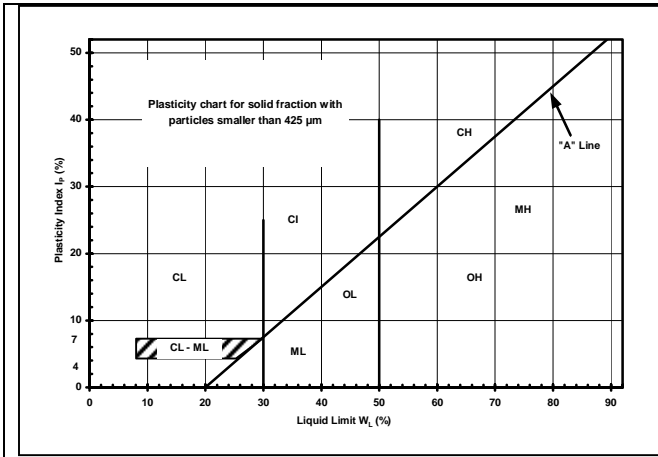
Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

Description			AECOM Log Symbols	USCS Classification	Laboratory Classification Criteria				
					Fines (%)	Grading	Plasticity	Notes	
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_u > 4$ $1 < C_c < 3$	Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4 < W_p < 7$ $C_u = \frac{D_{60}}{D_{10}}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$	
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12			Atterberg limits below "A" line or $W_p < 4$
			Clayey gravels, clayey sandy gravels		GC	> 12			Atterberg limits above "A" line or $W_p < 7$
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_u > 6$ $1 < C_c < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12			Atterberg limits below "A" line or $W_p < 4$
			Clayey sands, sand-clay mixtures		SC	> 12			Atterberg limits above "A" line or $W_p < 7$
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L < 50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML		Classification is Based upon Plasticity Chart		
		$W_L > 50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L < 30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30 < W_L < 50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L > 50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L < 50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L > 50$	Organic clays of high plasticity		OH				
	HIGHLY ORGANIC SOILS		Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	
	Asphalt		Till			AECOM			
	Concrete		Bedrock (Undifferentiated)						
	Fill		Bedrock (Limestone)						

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075		
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		10-20	some
				1-10	trace
* for example: gravelly, sandy clayey, silty					
Definition of Oversize Material					
COBBLES: 76mm to 300mm diameter					
BOULDERS: >300mm diameter					

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- qu - undrained shear strength (kPa) derived from unconfined compression testing.
- Tv - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- Lv - undrained shear strength (kPa) measured using a lab vane.
- Fv - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m³).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (WL, Wp)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

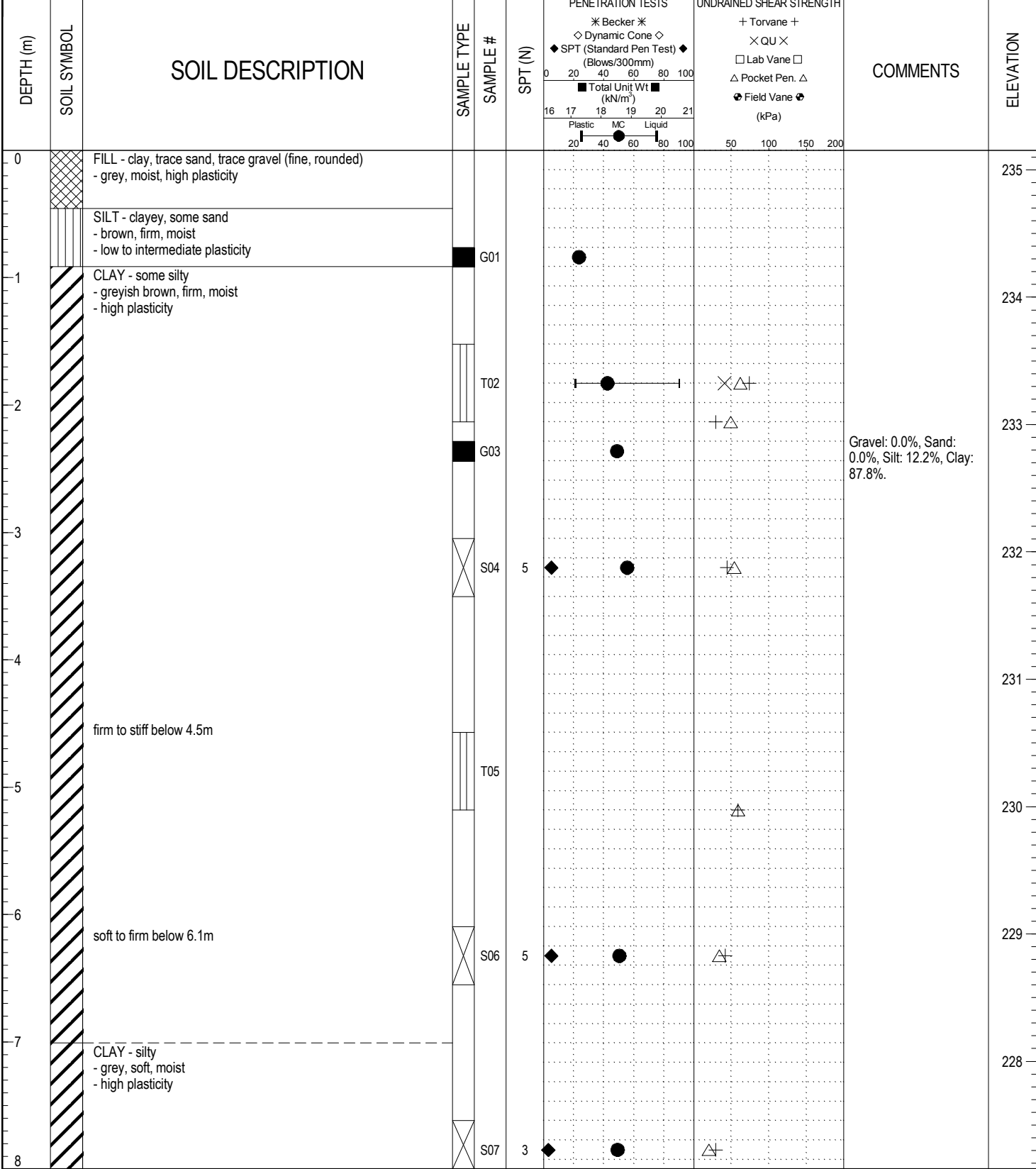
Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Eldridge & Haney Valve Chamber Upgrades CLIENT: City of Winnipeg TESTHOLE NO: TH13-01
 LOCATION: Northwest of Eldridge & Haney Intersection (0624616, 5523704) PROJECT NO.: 60297251
 CONTRACTOR: Maple Leaf Drilling Ltd. METHOD: Acker Renegade 125mm SSA ELEVATION (m): 235.15

SAMPLE TYPE GRAB SHELBY TUBE SPLIT SPOON BULK NO RECOVERY CORE



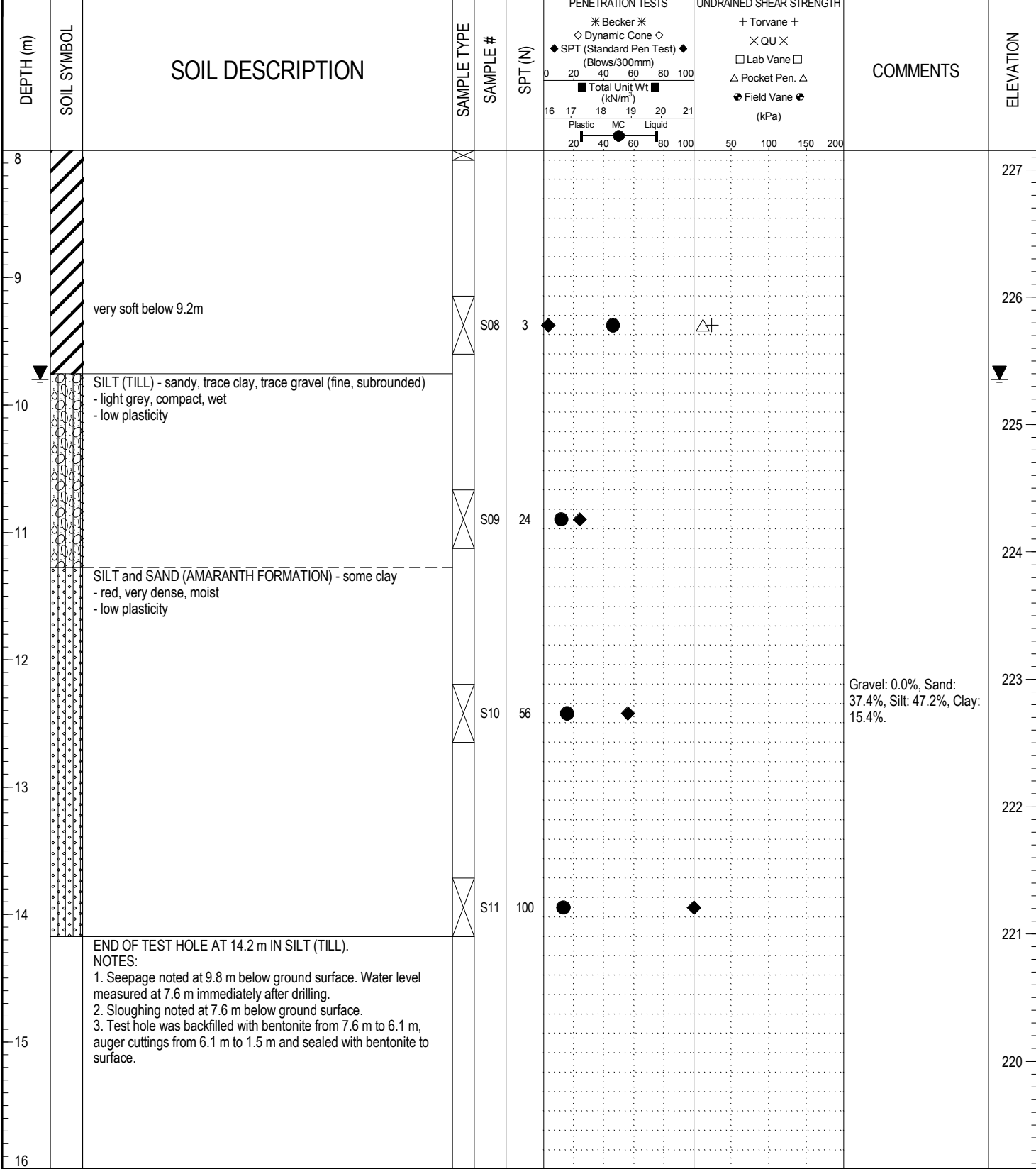
LOG OF TEST HOLE APRIL 2013 INVESTIGATION.GPJ UMA WINN.GDT 5/30/13



LOGGED BY: Aaron Kaluzniak COMPLETION DEPTH: 14.17 m
 REVIEWED BY: Alex Hill COMPLETION DATE: 4/26/13
 PROJECT ENGINEER: Marvin McDonald Page 1 of 2

PROJECT: Eldridge & Haney Valve Chamber Upgrades CLIENT: City of Winnipeg TESTHOLE NO: TH13-01
 LOCATION: Northwest of Eldridge & Haney Intersection (0624616, 5523704) PROJECT NO.: 60297251
 CONTRACTOR: Maple Leaf Drilling Ltd. METHOD: Acker Renegade 125mm SSA ELEVATION (m): 235.15

SAMPLE TYPE GRAB SHELBY TUBE SPLIT SPOON BULK NO RECOVERY CORE



LOG OF TEST HOLE APRIL 2013 INVESTIGATION.GPJ UMA WINN.GDT 5/30/13



LOGGED BY: Aaron Kaluzniak COMPLETION DEPTH: 14.17 m
 REVIEWED BY: Alex Hill COMPLETION DATE: 4/26/13
 PROJECT ENGINEER: Marvin McDonald Page 2 of 2

AECOM

Appendix C

Lab Test Results

Memorandum

To Alex Hill Page 1

CC

Subject Eldridge & Haney Valve Chamber Upgrades

From Stephen Petsche

Date May 20, 2013 60297251

Attached are testing results for the above noted project. The testing included ten (10) Moisture Content tests, one (1) Atterberg Limits test, two (2) Grain Size Distribution (hydrometer method) tests and one (1) Oedometer Consolidation test on samples submitted to the lab. The testing also included Torvane, Pocket Penetrometer, Unconfined Compressive Strength, Moisture Content, Bulk Density and Visual Description on one (1) Shelby tube sample.

If you have any questions, please call.

Sincerely,



Stephen Petsche, C.E.T.
Coordinator, Lab and Technical Services

Attach.

MOISTURE CONTENT

JOB No.: 60297251

DATE: April 30, 2013

CLIENT: City of Winnipeg

PROJECT: Eldridge & Haney Valve Chamber Upgrades

HOLE NO.	TH13-01	-	-	-	-	-
SAMPLE NO.	G01	G03	S04	S06	S07	S08
DEPTH (FT)	2.5	7.5	10.0	20.0	25.0	30.0
MOISTURE CONTENT %	23.5	48.8	55.6	50.4	49.2	46.1
HOLE NO.	TH13-01	-	-			
SAMPLE NO.	S09	S10	S11			
DEPTH (FT)	35.0	40.0	45.0			
MOISTURE CONTENT %	11.6	15.5	13.0			
HOLE NO.						
SAMPLE NO.						
DEPTH (FT)						
MOISTURE CONTENT %						
HOLE NO.						
SAMPLE NO.						
DEPTH (FT)						
MOISTURE CONTENT %						

NOTES:



MATERIALS LABORATORY

AECOM

99 Commerce Drive, Winnipeg, MB R3P 0Y7 Canada

tel (204) 477-5381 fax (204) 284-2040

ATTERBERG
(ASTM D4318-10)



MATERIALS LABORATORY

AECOM

99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada

tel (204) 477-5381 fax (204) 284-2040

JOB No.: 60297251
 CLIENT: City of Winnipeg
 PROJECT: Eldridge & Haney Valve Chamber Upgrades
 LOCATION:

DATE: 2-May-13
 TEST HOLE: TH13-01
 SAMPLE: T02
 DEPTH: 5.0'
 TECH.: ML

Liquid Limit

WATER CONTENT

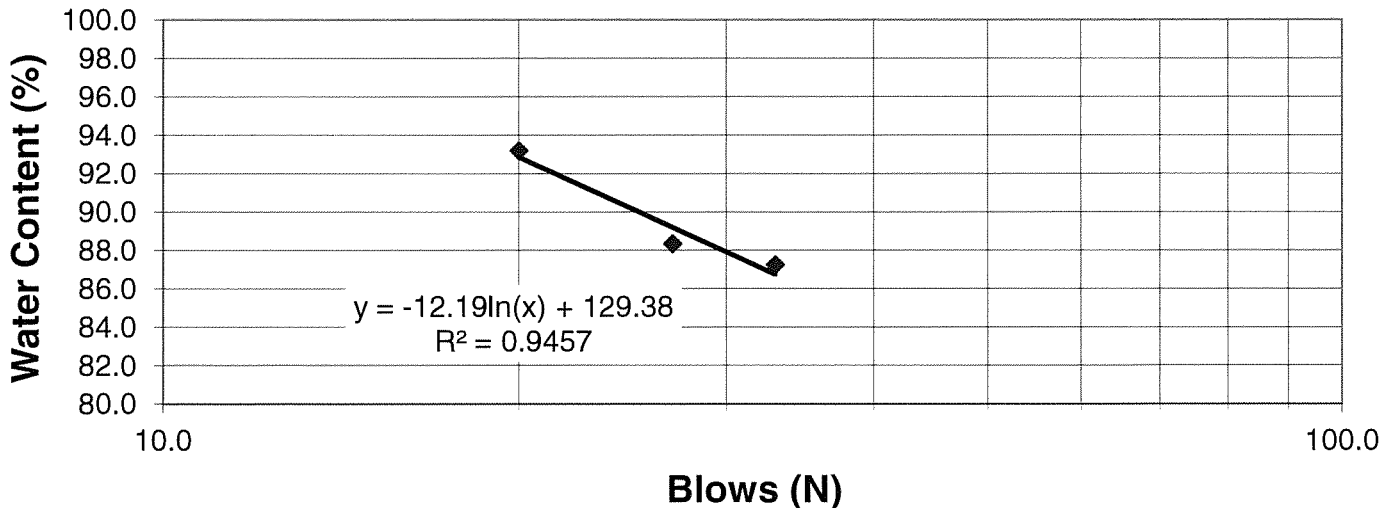
Blows	33	27	20		
WT. SAMPLE WET + TARE (gr)	92.118	87.738	93.122		
WT. SAMPLE DRY + TARE (gr)	86.498	82.824	87.401		
WT. TARE (gr)	80.057	77.262	81.262		
WT. WATER (gr)	5.620	4.914	5.721		
WT. DRY SOIL (gr)	6.441	5.562	6.139		
MOISTURE CONTENT (%)	87.254	88.350	93.191		

Plastic Limit

WATER CONTENT

WT. SAMPLE WET + TARE (gr)	89.251	86.543			
WT. SAMPLE DRY + TARE (gr)	87.698	85.446			
WT. TARE (gr)	80.239	80.233			
WT. WATER (gr)	1.553	1.097			
WT. DRY SOIL (gr)	7.459	5.213			
MOISTURE CONTENT (%)	20.820	21.044			

LIQUID LIMIT



Liquid Limit = 90.1

Plastic Limit = 20.9

Plasticity Index = 69.2

GRAIN SIZE DISTRIBUTION
(ASTM D422-63)



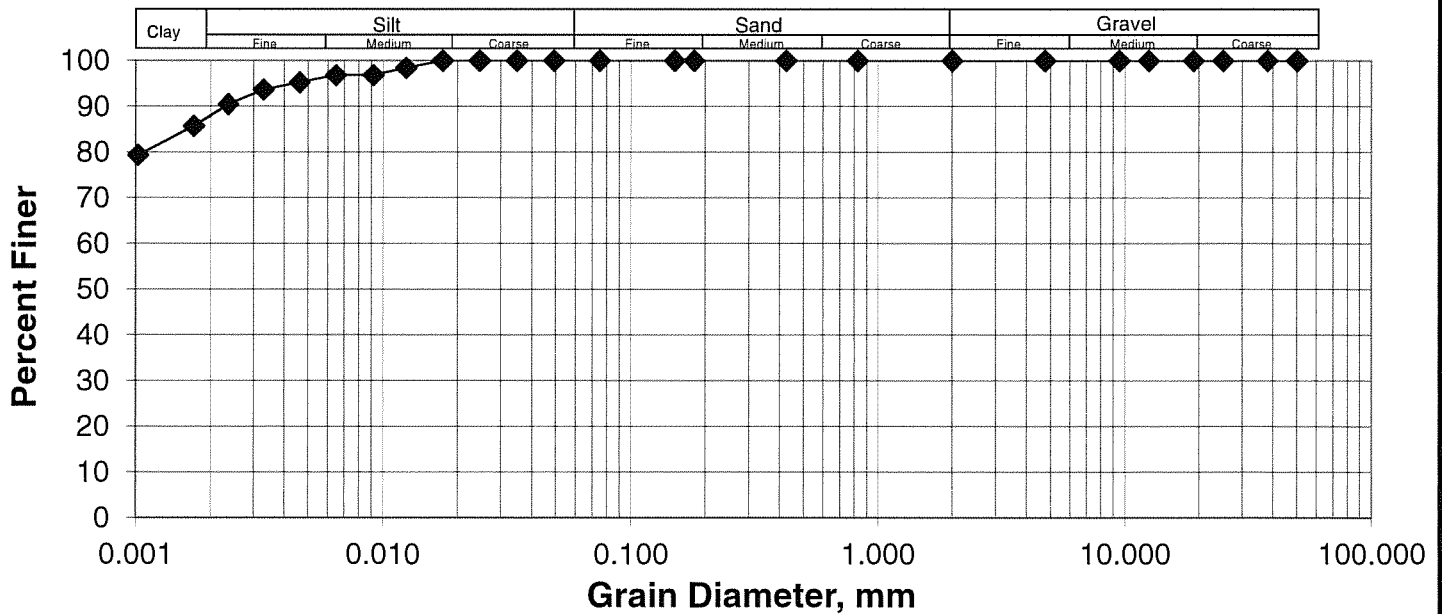
MATERIALS LABORATORY
AECOM
99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 477-5381 fax (204) 284-2040

Job No.: 60297251
Client: City of Winnipeg
Project: Eldridge & Haney Valve Chamber Upgrades
Date Tested: 2-May-13
Tested By: ML

Hole No.: TH13-01
Sample No.: G03
Depth: 7.5'
Date Sampled: 26-Apr-13
Sampled By: AECOM (AK)

GRAVEL SIZES		SAND SIZES		FINES	
Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing
50.0	100.0	2.00	100.0	0.0750	100.0
38.0	100.0	0.83	100.0	0.0491	100.0
25.0	100.0	0.43	100.0	0.0347	100.0
19.0	100.0	0.18	100.0	0.0246	100.0
12.5	100.0	0.15	100.0	0.0174	100.0
9.5	100.0	0.075	100.0	0.0124	98.4
4.75	100.0			0.0091	96.8
2.00	100.0			0.0065	96.8
				0.0046	95.2
				0.0033	93.6
				0.0024	90.5
				0.0017	85.7
				0.0010	79.3

GRAIN SIZE DISTRIBUTION CURVE



Gravel	0.0%	Silt	12.2%
Sand	0.0%	Clay	87.8%

** Note: Soil Classification based on Grain Size from Canadian Foundation Engineering Manual, 3rd edition (1992).

GRAIN SIZE DISTRIBUTION

(ASTM D422-63)



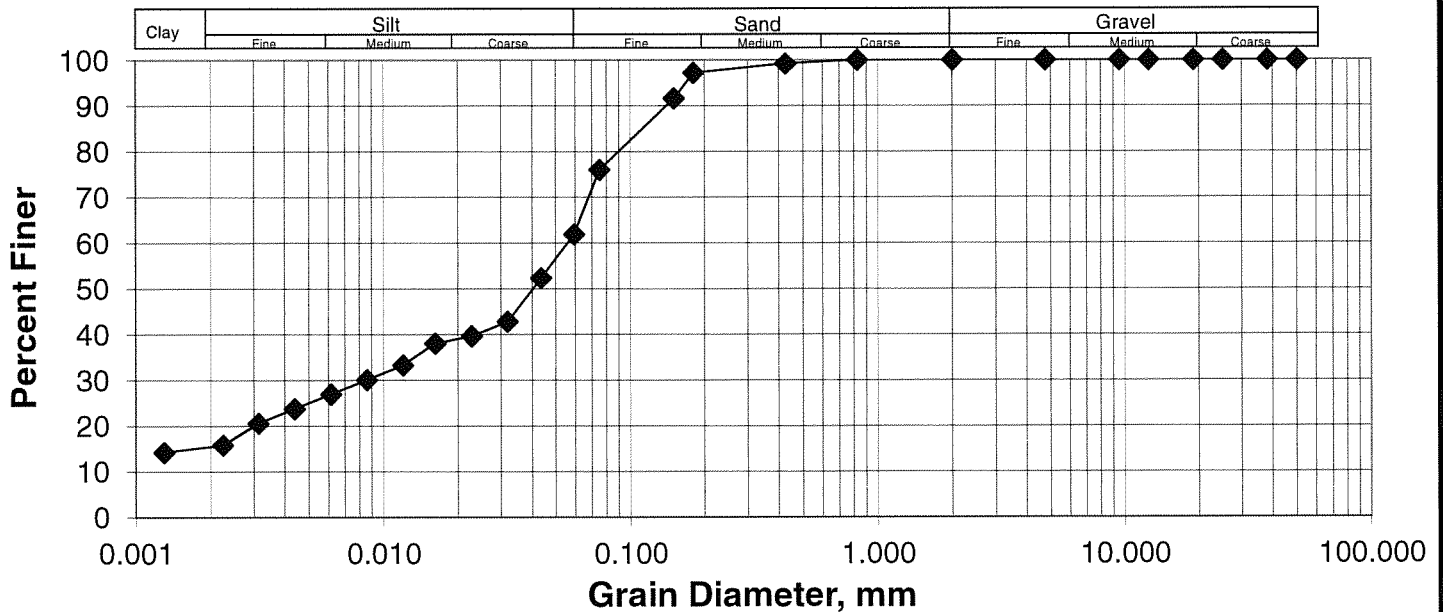
MATERIALS LABORATORY
 AECOM
 99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
 tel (204) 477-5381 fax (204) 284-2040

Job No.: 60297251
 Client: City of Winnipeg
 Project: Eldridge & Haney Valve Chamber Upgrades
 Date Tested: 2-May-13
 Tested By: ML

Hole No.: TH13-01
 Sample No.: S10
 Depth: 40.0'
 Date Sampled: 26-Apr-13
 Sampled By: AECOM (AK)

GRAVEL SIZES		SAND SIZES		FINES	
Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing	Grain Size (mm.)	Total Percent Passing
50.0	100.0	2.00	100.0	0.0750	76.0
38.0	100.0	0.83	100.0	0.0592	61.9
25.0	100.0	0.43	99.2	0.0435	52.3
19.0	100.0	0.18	97.2	0.0318	42.8
12.5	100.0	0.15	91.6	0.0228	39.6
9.5	100.0	0.075	76.0	0.0162	38.1
4.75	100.0			0.0120	33.3
2.00	100.0			0.0086	30.1
				0.0061	26.9
				0.0044	23.8
				0.0031	20.6
				0.0022	15.8
				0.0013	14.2

GRAIN SIZE DISTRIBUTION CURVE



Gravel	0.0%	Silt	47.2%
Sand	37.4%	Clay	15.4%

** Note: Soil Classification based on Grain Size from Canadian Foundation Engineering Manual, 3rd edition (1992).

AECOM - SOILS LABORATORY
SHEAR STRENGTH, MOISTURE CONTENT & DENSITY CALCULATIONS



CLIENT: City of Winnipeg
 PROJECT: Eldridge & Haney Valve Chamber Upgrades
 JOB NO.: 60297251

TEST HOLE NO.:	TH13-01
SAMPLE NO.:	T02
SAMPLE DEPTH:	5.0'
DATE TESTED:	30-Apr-13
SHEAR STRENGTH TESTS	
TORVANE	
Reading	0.30
Vane Size (S, M, L)	S
Undrained Shear Strength (kPa)	73.6
Undrained Shear Strength (ksf)	1.54
POCKET PENETROMETER	
Reading - Qu (tsf)	1.25
Undrained Shear Strength (kPa)	59.9
Reading - Qu (tsf)	1.50
Undrained Shear Strength (kPa)	71.8
Reading - Qu (tsf)	1.25
Undrained Shear Strength (kPa)	59.9
UNCONFINED COMPRESSIVE STRENGTH TEST	
Unconfined compressive strength (kPa)	81.6
Unconfined compressive strength (ksf)	1.7
Undrained Shear Strength (kPa)	40.8
Undrained Shear Strength (ksf)	0.852
MOISTURE CONTENT	
Tare Number	B11
Wt. Sample wet + tare (g)	366.5
Wt. Sample dry + tare (g)	259.8
Wt. Tare (g)	8.3
Moisture Content %	42.4
BULK DENSITY	
Sample Wt. (g)	1035.3
Diameter 1 (cm)	7.14
Diameter 2 (cm)	7.17
Diameter 3 (cm)	7.16
Avg. Diameter (cm)	7.16
Length 1 (cm)	14.39
Length 2 (cm)	14.38
Length 3 (cm)	14.37
Avg. Length (cm)	14.38
Volume (cm ³)	578.5
Moisture content (%)	42.4
Bulk Density (g/cm ³)	1.790
Bulk Density (kN/m³)	17.6
Bulk Density (pcf)	111.7
Dry Density (kN/m³)	12.32

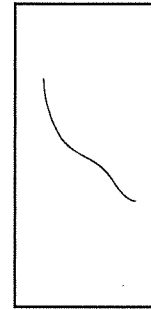
AECOM - SOILS LABORATORY
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS (ASTM D2166)



CLIENT:	City of Winnipeg
PROJECT:	Eldridge & Haney Valve Chamber Upgrades
JOB NO.:	60297251

TEST HOLE NO.:	TH13-01
SAMPLE NO.:	T02
SAMPLE DEPTH:	5.0'
SAMPLE DATE:	26-Apr-13
TEST DATE:	30-Apr-13

SOIL DESCRIPTION:	
CLAY; trace silt, trace organics, brown, moist, firm, high plasticity, homogeneous	
MOISTURE CONTENT:	42.4



FAILURE SKETCH

SAMPLE DIAM.(Do):	71.57	(mm)	INITIAL AREA, A ₀ :	4022.6	(mm ²)
SAMPLE LENGTH, (L ₀):	143.80	(mm)	PISTON RATE:	0.051	(inches / minute)
L / D RATIO:	2.01	(2 < L/D < 2.5)	AXIAL STRAIN RATE, R:	0.90	(0.5<R<2 % / minute)

TEST DATA - DIAL READINGS							
AXIAL COMPRESSION	PROVING RING	TOTAL AXIAL STRAIN, E _t	AVERAGE CROSS-SECTIONAL AREA, A	APPLIED AXIAL LOAD, P	COMPRESSIVE STRESS, σ _c		
					(psi)	(ksf)	(kPa)
0.01	0.0007	0.00	6.24	6.56	1.05	0.151	7.3
0.02	0.0013	0.15	6.24	12.18	1.95	0.281	13.4
0.03	0.0019	0.30	6.25	17.80	2.85	0.410	19.6
0.03	0.0025	0.45	6.26	23.43	3.74	0.539	25.8
0.04	0.0030	0.60	6.27	28.11	4.48	0.645	30.9
0.05	0.0034	0.75	6.28	31.86	5.07	0.730	35.0
0.06	0.0039	0.90	6.29	36.54	5.81	0.836	40.0
0.07	0.0044	1.05	6.30	41.23	6.54	0.942	45.1
0.08	0.0047	1.20	6.31	44.04	6.98	1.005	48.1
0.09	0.0050	1.35	6.32	46.85	7.41	1.067	51.1
0.09	0.0053	1.50	6.33	49.66	7.85	1.130	54.1
0.10	0.0056	1.65	6.34	52.47	8.28	1.192	57.1
0.11	0.0058	1.80	6.35	54.35	8.56	1.233	59.0
0.12	0.0060	1.95	6.36	56.22	8.84	1.273	61.0
0.13	0.0062	2.10	6.37	58.09	9.12	1.313	62.9
0.14	0.0064	2.25	6.38	59.97	9.40	1.354	64.8
0.14	0.0065	2.40	6.39	60.91	9.53	1.373	65.7
0.15	0.0067	2.55	6.40	62.78	9.81	1.413	67.6
0.16	0.0068	2.70	6.41	63.72	9.94	1.432	68.6
0.17	0.0070	2.85	6.42	65.59	10.22	1.472	70.5
0.18	0.0071	3.00	6.43	66.53	10.35	1.490	71.4
0.19	0.0072	3.15	6.44	67.46	10.48	1.509	72.2
0.20	0.0074	3.30	6.45	69.34	10.75	1.548	74.1
0.20	0.0075	3.45	6.46	70.28	10.88	1.567	75.0
0.21	0.0076	3.60	6.47	71.21	11.01	1.585	75.9
0.22	0.0077	3.75	6.48	72.15	11.14	1.604	76.8
0.23	0.0078	3.90	6.49	73.09	11.26	1.622	77.7
0.24	0.0078	4.05	6.50	73.09	11.25	1.619	77.5
0.25	0.0079	4.20	6.51	74.02	11.37	1.638	78.4
0.26	0.0080	4.35	6.52	74.96	11.50	1.656	79.3
0.26	0.0081	4.50	6.53	75.90	11.62	1.674	80.1
0.27	0.0081	4.65	6.54	75.90	11.61	1.671	80.0
0.28	0.0082	4.80	6.55	76.83	11.73	1.689	80.9
0.29	0.0082	4.95	6.56	76.83	11.71	1.687	80.8
0.30	0.0083	5.10	6.57	77.77	11.84	1.704	81.6
0.31	0.0083	5.25	6.58	77.77	11.82	1.702	81.5
0.31	0.0083	5.41	6.59	77.77	11.80	1.699	81.4
0.32	0.0083	5.56	6.60	77.77	11.78	1.696	81.2
0.33	0.0083	5.71	6.61	77.77	11.76	1.694	81.1
0.34	0.0083	5.86	6.62	77.77	11.74	1.691	81.0
0.35	0.0083	6.01	6.63	77.77	11.72	1.688	80.8
0.36	0.0083	6.16	6.64	77.77	11.71	1.686	80.7
0.37	0.0083	6.31	6.65	77.77	11.69	1.683	80.6
0.37	0.0082	6.46	6.67	76.83	11.53	1.660	79.5
0.38	0.0082	6.61	6.68	76.83	11.51	1.657	79.3
0.39	0.0082	6.76	6.69	76.83	11.49	1.655	79.2
0.40	0.0081	6.91	6.70	75.90	11.33	1.632	78.1

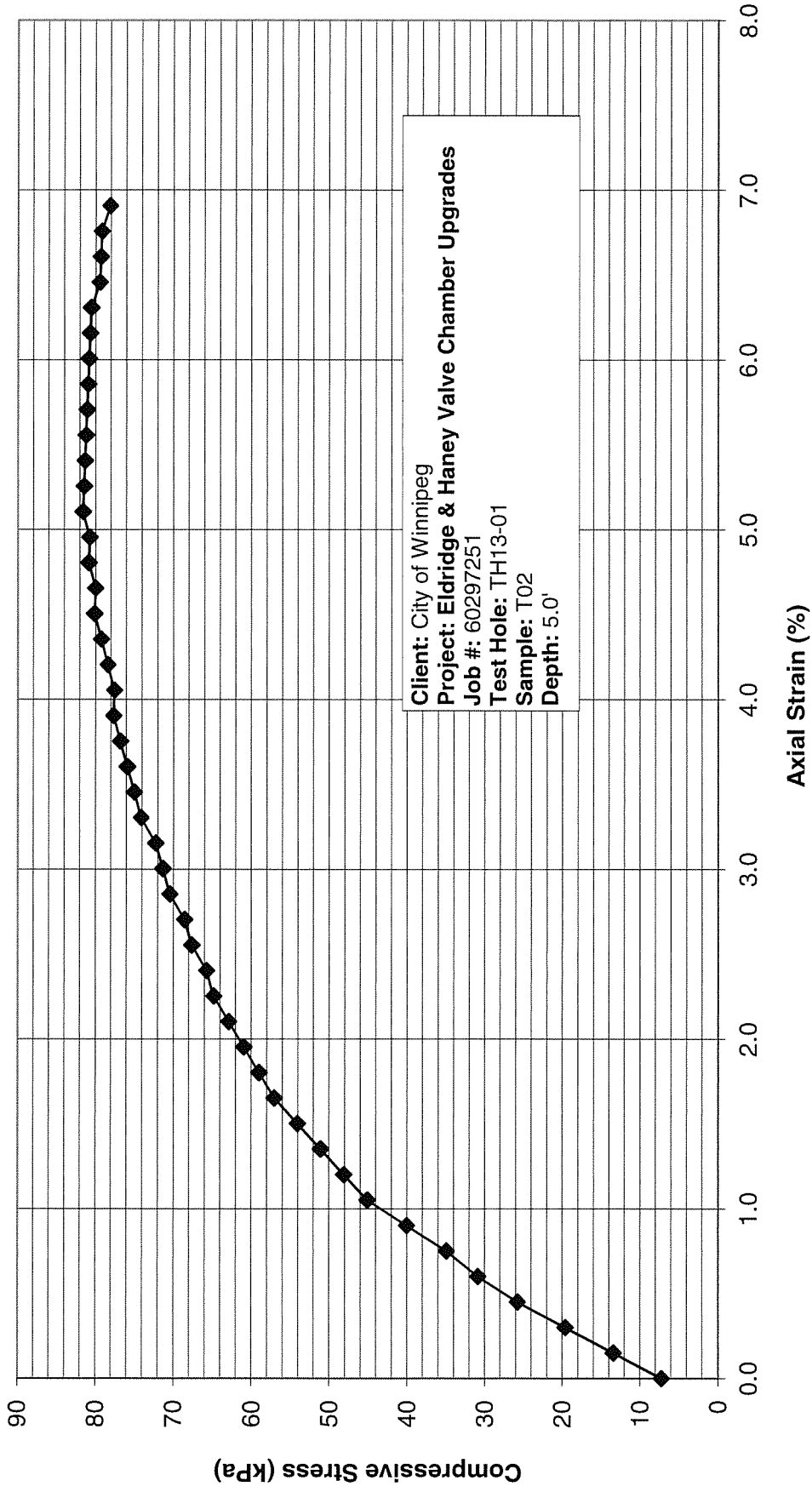
UNCONFINED COMPRESSIVE STRENGTH, q _u :	81.61	kPa
(based on maximum q _u value)	1.704	ksf
UNDRAINED SHEAR STRENGTH, S _u :	40.80	kPa
(based on maximum q _u value)	0.852	ksf

NOTES:

AECOM

AECOM

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS
(ASTM D2166)



Consolidation Test



MATERIALS LABORATORY

AECOM

99 Commerce Dr., Winnipeg, MB R3P 0Y7 Canada
tel (204) 284-0580 fax (204) 475-3646

Client: City of Winnipeg
Project: Eldridge & Haney Valve Chamber Upgrades
Job No: 60297251
Date: May 2 to 15, 2013

Hole No. TH13-01
Sample No. T05
Depth: 15.0'
Sample Description: Clay

Box Size 70.0 mm φ

Height 20 mm

Moisture Content			Density		
	Initial	Final		Initial	Final
Tare Number			Wt. Sh. Box & Soil (g)	237.7	227.4
Wt. Wet Soil & Tare (g)	301.7	227.4	Wt. Sh. Box (g)	104.5	104.5
Wt. Dry Soil & Tare (g)	200.8	194.6	Wt. Soil Specimen (g)	133.2	122.9
Wt. Water (g)	100.9	32.8	Height of Spec. (mm)	20.0	17.2
Wt. Tare (g)	8.5	104.5	Volume (mm ³)	76967	66166
% Moisture	52.5	36.4	Bulk Density (kN/m ³)	17.31	18.57
Hs (mm)	8.4	8.7	Dry Density (kN/m ³)	11.35	13.62

Machine # 1
e (void Ratio) 1.38

Ring #
Spec. Gravity (assumed) 2.7

Load 0.209 kg

Free Swell								
Time	Elapsed Time (min)	Normal Dial Reading	Sq. Root Elapsed Time (min)	Deflection Disp. (mm)	Normal Strain %	Void Ratio (mm)	Pressure kPa	Consolidation (%)
5/2/2013 8:30	0	1576	0	0.00	0.00	1.3787	0.53	-
5/2/2013 17:00	510	1661	22.58	0.22	1.08	1.4044	0.53	-
5/3/2013 8:00	1410	1764	37.55	0.48	2.39	1.4355	0.53	-
5/3/2013 17:00	1950	1767	44.16	0.49	2.43	1.4364	0.53	-
5/6/2013 8:00	5730	1768	75.70	0.49	2.44	1.4367	0.53	-

Load 2.273 kg 5 LBS

Consolidation Load 1								
Time	Elapsed Time (min)	Normal Dial Reading	Sq. Root Elapsed Time (min)	Deflection Disp. (mm)	Normal Strain %	Void Ratio (mm)	Pressure kPa	Consolidation (%)
5/6/2013 8:00	0	1770	0	0.00	0.00	1.44	63.70	0.00
	0.25	1758	0.50	-0.03	-0.15	1.43	63.70	0.15
	0.5	1754	0.71	-0.04	-0.20	1.43	63.70	0.20
	1	1751	1.00	-0.05	-0.24	1.43	63.70	0.24
	2	1746	1.41	-0.06	-0.30	1.43	63.70	0.30
	4	1741	2.00	-0.07	-0.37	1.43	63.70	0.37
	8	1734	2.83	-0.09	-0.46	1.43	63.70	0.46
	15	1728	3.87	-0.11	-0.53	1.42	63.70	0.53
	30	1724	5.48	-0.12	-0.58	1.42	63.70	0.58
	60	1721	7.75	-0.12	-0.62	1.42	63.70	0.62
	120	1719	10.95	-0.13	-0.65	1.42	63.70	0.65
	240	1717	15.49	-0.13	-0.67	1.42	63.70	0.67
	480	1715	21.91	-0.14	-0.70	1.42	63.70	0.70
	1440	1712	37.95	-0.15	-0.74	1.42	63.70	0.74

Load 4.545 kg 10 LBS

Consolidation Load 2								
Time	Elapsed Time (min)	Normal Dial Reading	Sq. Root Elapsed Time (min)	Deflection Disp. (mm)	Normal Strain %	Void Ratio (mm)	Pressure kPa	Consolidation (%)
5/7/2013 8:00	0	1712	0	0.00	0.00	1.42	127.41	0.74
	0.25	1694	0.50	-0.05	-0.23	1.41	127.41	0.97
	0.5	1690	0.71	-0.06	-0.28	1.41	127.41	1.02
	1	1685	1.00	-0.07	-0.34	1.41	127.41	1.08
	2	1678	1.41	-0.09	-0.43	1.41	127.41	1.17
	4	1664	2.00	-0.12	-0.61	1.40	127.41	1.35
	8	1653	2.83	-0.15	-0.75	1.40	127.41	1.49
	15	1642	3.87	-0.18	-0.89	1.40	127.41	1.63
	30	1628	5.48	-0.21	-1.07	1.39	127.41	1.80
	60	1617	7.75	-0.24	-1.21	1.39	127.41	1.94
	120	1610	10.95	-0.26	-1.30	1.39	127.41	2.03
	240	1606	15.49	-0.27	-1.35	1.39	127.41	2.08
	480	1602	21.91	-0.28	-1.40	1.39	127.41	2.13
	1440	1596	37.95	-0.29	-1.47	1.38	127.41	2.21

Load

6.818 kg

15 LBS

Consolidation Load 3

Time	Elapsed Time (min)	Normal Dial Reading	Sq. Root Elapsed Time (min)	Deflection Disp. (mm)	Normal Strain %	Void Ratio (mm)	Pressure kPa	Consolidation (%)
5/8/2013 8:00	0	1596	0	0.00	0.00	1.38	191.11	2.21
	0.25	1586	0.50	-0.03	-0.13	1.38	191.11	2.34
	0.5	1583	0.71	-0.03	-0.17	1.38	191.11	2.37
	1	1580	1.00	-0.04	-0.20	1.38	191.11	2.41
	2	1575	1.41	-0.05	-0.27	1.38	191.11	2.48
	4	1567	2.00	-0.07	-0.37	1.38	191.11	2.58
	8	1557	2.83	-0.10	-0.50	1.37	191.11	2.71
	15	1546	3.87	-0.13	-0.64	1.37	191.11	2.84
	30	1532	5.48	-0.16	-0.81	1.36	191.11	3.02
	60	1522	7.75	-0.19	-0.94	1.36	191.11	3.15
	120	1515	10.95	-0.21	-1.03	1.36	191.11	3.24
	240	1511	15.49	-0.22	-1.08	1.36	191.11	3.29
	480	1502	21.91	-0.24	-1.19	1.36	191.11	3.40
	1440	1498	37.95	-0.25	-1.24	1.35	191.11	3.45

Load

13.636 kg

30 LBS

Consolidation Load 4

Time	Elapsed Time (min)	Normal Dial Reading	Sq. Root Elapsed Time (min)	Deflection Disp. (mm)	Normal Strain %	Void Ratio (mm)	Pressure kPa	Consolidation (%)
5/9/2013 8:00	0	1498	0	0.00	0.00	1.35	382.22	3.45
	0.25	1470	0.50	-0.07	-0.36	1.35	382.22	3.81
	0.5	1461	0.71	-0.09	-0.47	1.34	382.22	3.92
	1	1452	1.00	-0.12	-0.58	1.34	382.22	4.04
	2	1439	1.41	-0.15	-0.75	1.34	382.22	4.20
	4	1420	2.00	-0.20	-0.99	1.33	382.22	4.45
	8	1396	2.83	-0.26	-1.30	1.32	382.22	4.75
	15	1372	3.87	-0.32	-1.60	1.32	382.22	5.05
	30	1332	5.48	-0.42	-2.11	1.30	382.22	5.56
	60	1300	7.75	-0.50	-2.51	1.29	382.22	5.97
	120	1284	10.95	-0.54	-2.72	1.29	382.22	6.17
	240	1268	15.49	-0.58	-2.92	1.29	382.22	6.38
	480	1257	21.91	-0.61	-3.06	1.28	382.22	6.52
	1440	1243	37.95	-0.65	-3.24	1.28	382.22	6.69

Load

27.273 kg

60 LBS

Consolidation Load 5

Time	Elapsed Time (min)	Normal Dial Reading	Sq. Root Elapsed Time (min)	Deflection Disp. (mm)	Normal Strain %	Void Ratio (mm)	Pressure kPa	Consolidation (%)
5/10/2013 8:00	0	1243	0	0.00	0.00	1.28	764.43	6.69
	0.25	1209	0.50	-0.09	-0.43	1.27	764.43	7.12
	0.5	1199	0.71	-0.11	-0.56	1.26	764.43	7.25
	1	1188	1.00	-0.14	-0.70	1.26	764.43	7.39
	2	1171	1.41	-0.18	-0.91	1.26	764.43	7.61
	4	1146	2.00	-0.25	-1.23	1.25	764.43	7.92
	8	1110	2.83	-0.34	-1.69	1.24	764.43	8.38
	15	1065	3.87	-0.45	-2.26	1.22	764.43	8.95
	30	1005	5.48	-0.60	-3.02	1.21	764.43	9.72
	60	938	7.75	-0.77	-3.87	1.19	764.43	10.57
	120	885	10.95	-0.91	-4.55	1.17	764.43	11.24
	240	849	15.49	-1.00	-5.00	1.16	764.43	11.70
	480	823	21.91	-1.07	-5.33	1.15	764.43	12.03
	1440	794	37.95	-1.14	-5.70	1.14	764.43	12.40

Load

54.545 kg

120 LBS

Consolidation Load 6

Time	Elapsed Time (min)	Normal Dial Reading	Sq. Root Elapsed Time (min)	Deflection Disp. (mm)	Normal Strain %	Void Ratio (mm)	Pressure kPa	Consolidation (%)
5/13/2013 8:00	0	768	0	0.00	0.00	1.14	1528.87	12.40
	0.25	729	0.50	-0.10	-0.50	1.13	1528.87	12.89
	0.5	720	0.71	-0.12	-0.61	1.13	1528.87	13.00
	1	708	1.00	-0.15	-0.76	1.12	1528.87	13.16
	2	691	1.41	-0.20	-0.98	1.12	1528.87	13.37
	4	665	2.00	-0.26	-1.31	1.11	1528.87	13.70
	8	626	2.83	-0.36	-1.80	1.10	1528.87	14.20
	15	573	3.87	-0.50	-2.48	1.08	1528.87	14.87
	30	498	5.48	-0.69	-3.43	1.06	1528.87	15.82
	60	405	7.75	-0.92	-4.61	1.03	1528.87	17.01
	120	316	10.95	-1.15	-5.74	1.01	1528.87	18.14
	240	250	15.49	-1.32	-6.58	0.99	1528.87	18.97
	480	208	21.91	-1.42	-7.11	0.97	1528.87	19.51
	1440	174	37.95	-1.51	-7.54	0.96	1528.87	19.94

Unload

27.273 kg

60 LBS

Consolidation Unload 1

Time	Elapsed Time (min)	Normal Dial Reading	Sq. Root Elapsed Time (min)	Deflection Disp. (mm)	Normal Strain %	Void Ratio (mm)	Pressure kPa	Consolidation (%)
5/14/2013 8:00	0	174	0	0.00	0.00	0.96	764.43	-
	0.25	198	0.50	0.06	0.30	0.97	764.43	-
	0.5	202	0.71	0.07	0.36	0.97	764.43	-
	1	207	1.00	0.08	0.42	0.97	764.43	-
	2	213	1.41	0.10	0.50	0.97	764.43	-
	4	221	2.00	0.12	0.60	0.98	764.43	-
	8	230	2.83	0.14	0.71	0.98	764.43	-
	15	243	3.87	0.18	0.88	0.98	764.43	-
	30	256	5.48	0.21	1.04	0.99	764.43	-
	60	270	7.75	0.24	1.22	0.99	764.43	-
	120	277	10.95	0.26	1.31	0.99	764.43	-
	240	280	15.49	0.27	1.35	0.99	764.43	-
	480	283	21.91	0.28	1.38	1.00	764.43	-
	1440	285	37.95	0.28	1.41	1.00	764.43	-

Unload

13.636 kg

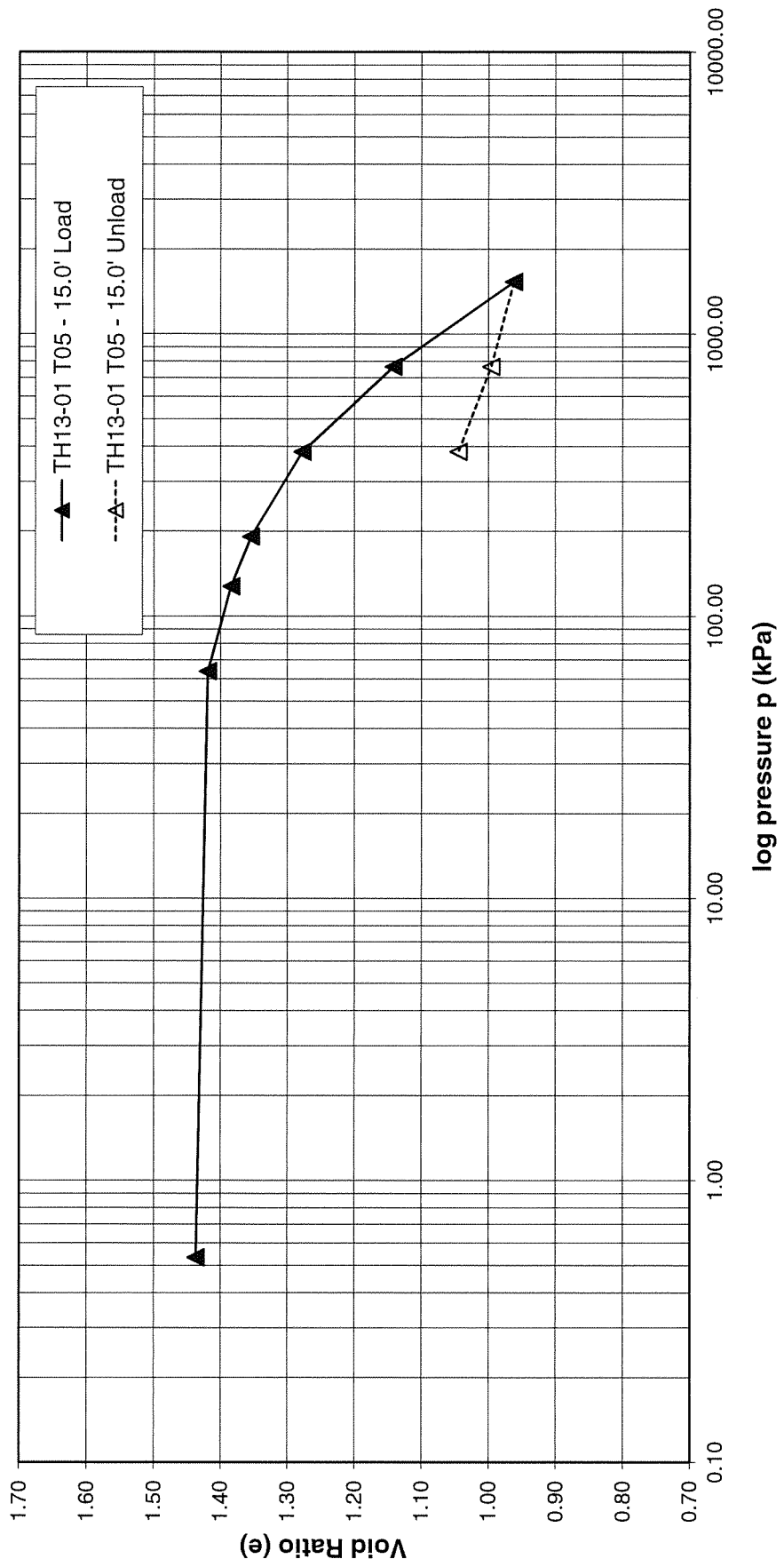
30 LBS

Consolidation Unload 2

Time	Elapsed Time (min)	Normal Dial Reading	Sq. Root Elapsed Time (min)	Deflection Disp. (mm)	Normal Strain %	Void Ratio (mm)	Pressure kPa	Consolidation (%)
5/15/2013 8:00	0	285	0	0.00	0.00	1.00	382.22	-
	0.25	303	0.50	0.05	0.23	1.00	382.22	-
	0.5	307	0.71	0.06	0.28	1.00	382.22	-
	1	313	1.00	0.07	0.36	1.00	382.22	-
	2	318	1.41	0.08	0.42	1.01	382.22	-
	4	326	2.00	0.10	0.52	1.01	382.22	-
	8	338	2.83	0.13	0.67	1.01	382.22	-
	15	354	3.87	0.18	0.88	1.02	382.22	-
	30	372	5.48	0.22	1.10	1.02	382.22	-
	60	396	7.75	0.28	1.41	1.03	382.22	-
	120	421	10.95	0.35	1.73	1.04	382.22	-
	240	433	15.49	0.38	1.88	1.04	382.22	-
	480	439	21.91	0.39	1.96	1.04	382.22	-
	1440	447	37.95	0.41	2.06	1.04	382.22	-

Consolidation Results - Void Ratio (e) versus log pressure p

Client: City of Winnipeg
Project: Eldridge & Haney Valve Chamber Upgrades
Project #: 60297251
Date: May 2 to 15, 2013

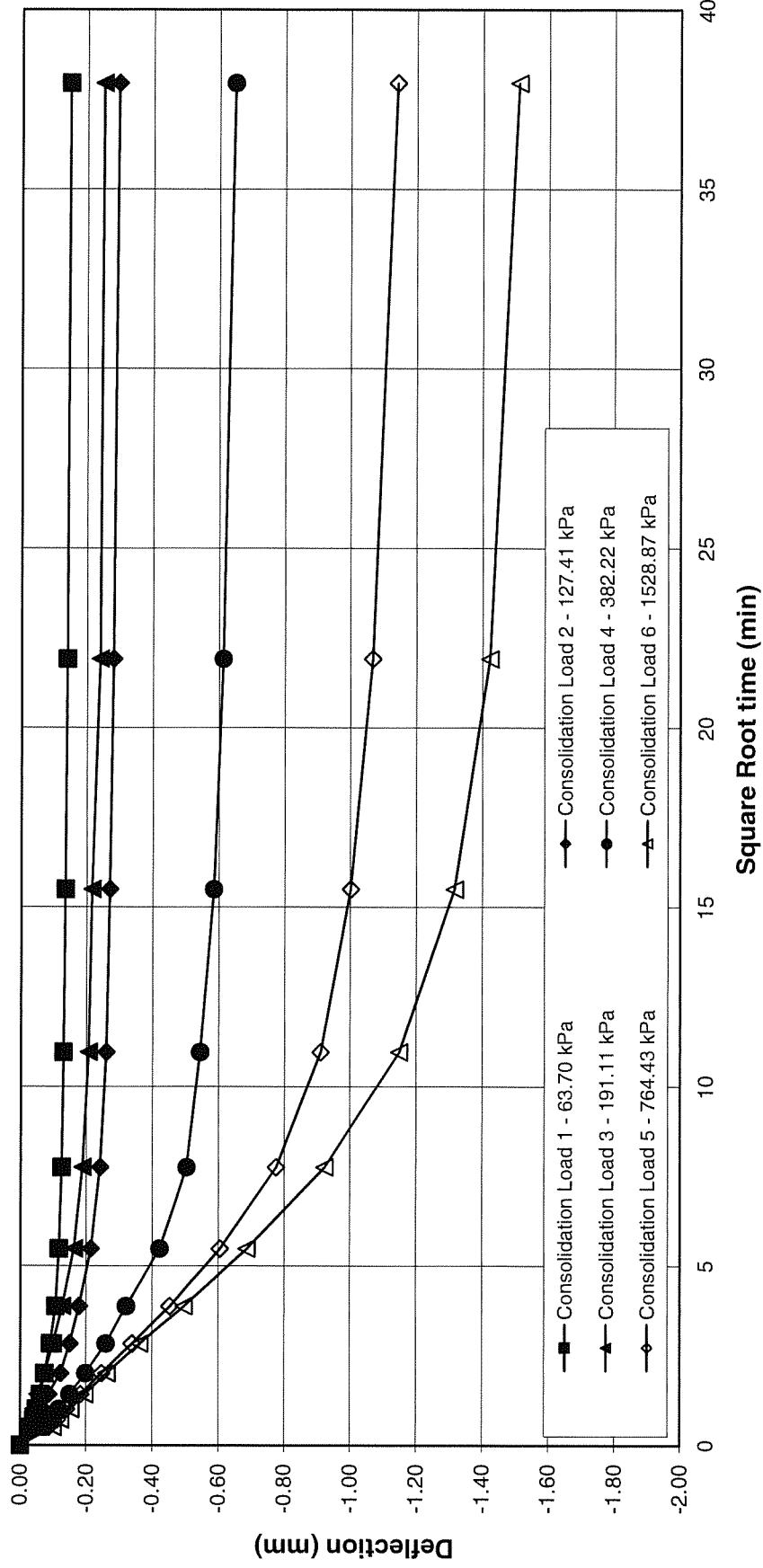



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AECOM.
99 Commerce Dr. Wpg. Mb
tel (204) 477-5381 fax (204) 284-2040

Deflection (mm) versus Normal Stress (σ)

Client: City of Winnipeg
 Project: Eldridge & Haney Valve Chamber Upgrades
 Project #: 60297251
 Date: May 2 to 15, 2013





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Appendix B

Geotechnical Technical Memo - Excavation Recommendations

Memorandum

To	Marvin McDonald	Page	1
CC	Adam Braun		
Subject	Eldridge and Haney Valve Chambers Upgrades- Excavation Recommendations		
From	Alex Hill		
Date	July 24, 2013	Project Number	60297251 (402.9)

1. Introduction

Further to the Geotechnical Investigation Memorandum issued by AECOM dated May 30, 2013 in regards to the Eldridge and Haney Valve Chamber Upgrades, the following recommendations relate specifically to the temporary support of the existing buried valve chamber, and those excavations required for the construction of the proposed valve chamber.

The following information has been provided to AECOM for the purpose of assisting with the submission of design recommendations:

- Dimensions of the existing buried valve chamber are 3.43 m x 4.36 m x 3.50 m;
- 0.85 m of overburden soils from the existing ground surface to the top of the existing valve chamber;
- Weight of the existing buried valve chamber is 665 kN;
- The buried valve chamber is subjected to an ultimate lateral force of 377 kN resulting from the feedermain.

As such, all recommendations included within this report should be read in conjunction with the AECOM Geotechnical Investigation Memorandum dated May 30, 2013.

2. Subsurface Conditions

Based on the findings contained within the AECOM Geotechnical Investigation Memorandum dated May 30, 2013, the following soil profile in descending order has been identified:

- Clay Fill
- Clayey Silt (Upper Complex)
- Silty Clay (Lacustrine Clay)
- Silt Till (Glacial Till)
- Sandy Silt (Amaranth Formation)

A test hole location plan is presented in Appendix A and the test hole log is shown in Appendix B attached to this Memorandum.

2.1 Groundwater and Sloughing Condition

Sloughing was encountered during drilling within the Lacustrine clay at a depth of 7.6 m below ground surface (227.55 m UTM elevation) in test hole TH13-01. Seepage was also noted during drilling at a depth of 9.8 m below ground surface near the Glacial Till contact.

Groundwater conditions may vary seasonally, annually or due to construction activities.

3. Excavation Plan and Temporary Shoring

The method of excavation and support for excavation sidewalls and buried structures (i.e., existing valve chamber) are the responsibility of the contractor and subject to applicable Occupational Health and Safety (OHS) requirements of Manitoba Labour regarding excavation and trench safety. This can be found in the Workplace Safety and Health Regulations and Guidelines for Excavation Work. The information provided below is for use by the owner and engineer, and should not be interpreted to mean that AECOM is assuming responsibility for the contractor's actions or site safety.

3.1 Lateral Support of Existing Buried Valve Chamber

Analysis performed by AECOM relating to the removal of soils along the eastern side of the existing valve chamber indicates that the factor of safety (FS) against sliding resistance for the existing structure is less than 1.3 (the minimum FS required for short-term construction). This therefore implies that lateral support to the existing buried valve chamber will be required during the excavation of the adjacent soils while construction is ongoing to ensure an adequate FS.

Special consideration should be given to the lateral support of the existing buried valve chamber during the removal of adjacent soils for the purposes of constructing the proposed chamber. This should be considered as part of the temporary works design methodology undertaken by the works contractor. Support to the existing chamber should be sufficient to compensate for the anticipated thrust force of 377 kN.

Steel H piles may be considered as a potential suitable lateral support for the valve chamber during excavation work. Steel H piles should be installed prior to excavation work or significant modifications to ground elevations. The piles may either be driven in place or predrilled to a predetermined depth should precise vertical control alignment of the piles be required. Predrilled piles may also be considered where buried obstructions at depth (i.e., cobbles, boulders) are anticipated. The embedment depth of the piles should be sufficient to resist lateral movement. The exact length, toe elevation and number of piles should be determined by the contractor based on the information provided in the AECOM Geotechnical Investigation Memorandum (dated May 30, 2013).

Alternate design solutions may be adopted by individual contractors which are not discussed within this Memorandum but which fulfill the necessary requirements as set out in this document. However, responsibility of the temporary works design and methodology rests with the works contractor. It is recommended that AECOM review the contractors proposed temporary works design methodology and drawings prior to the commencement of field operations.

All precautions should be taken to ensure that the foundation of the existing buried valve chamber is not undermined during the excavation of the proposed valve chamber, and thus potentially leading to localised softening of the foundation soils and subsequent reduction in strength.

3.2 Unsupported Excavations

The following guidelines regarding excavation slopes are intended only to provide guidance for construction supervision. The stability of the excavation slopes should be monitored regularly by knowledgeable geotechnical personnel. Contractors should acknowledge these concerns and develop a Safe Excavation Plan accordingly.

It is expected that slopes cut not steeper than 1.0(H):1.0(V) would perform satisfactorily within the clay for excavations not exceeding 2 m in depth for a brief construction period (one month or less). Flatter slopes would be required in wet soil or fill material. Detailed stability assessment should be carried out for unsupported excavations greater than 2 m in depth or if they are to remain open for an extended period of time. Benching and placement of gravel buttresses or sand bags may be required to control localized caving and provide support for the excavation slopes. If this technique is employed, it would be necessary to provide extra width at the base of the excavation for drainage provision and buttressing. Surcharge loading, including the excavation spoil, should be kept to a minimum distance equal to the excavation depth away from the cut slope crest. However, it is anticipated that excavation depths will be greater than 2 m to facilitate the proposed construction. With time and the presence of seepage and/or precipitation, the stability of temporary cuts can be significantly reduced. Runoff water should be prevented from entering excavations. To avoid the possibility of piping within the excavation, dewatering should be performed with well points located outside of the supported excavation. Construction dewatering and the assessment of the related impact is the responsibility of the Contractor. The Contractor should submit a safe excavation plan for Engineer review. Construction should proceed as rapidly as feasible to limit the time the excavations are left open.

3.3 Supported Excavations

It is anticipated that supported excavations will be necessary for the proposed buried valve chamber where excavation depths are greater than 3 m. In this regard, the following options may be considered but not limited to the following;

- Solider piles with timber lagging; and
- Braced or tied back cantilevered shoring.

Solider piles may be considered for use as support around the periphery of the excavation, and may be driven or pre-drilled to provide close control of alignment and location given the sensitive nature of maintaining lateral support to the existing buried valve chamber. The final toe depth of the piles will be dependent upon the contractor's design and methodology.

Good contact between lagging and the retained soil is crucial to maintaining stability of the excavation sidewalls and sufficient lateral resistance. Free draining sand should be used to fill the voids behind the lagging or sheet piles. At depths below 4 m, additional support such as bracing or tiebacks will be required.

The use of cantilevered shoring (i.e., sheet piling) is typically limited to depths of approximately 4 m without additional bracing or use of tiebacks. Beyond this depth the shoring will generally have to be braced or tied back. The design should account for all applicable surcharge loads and hydrostatic pressures. Shoring is usually designed to keep movements around the perimeter of the excavation within acceptable limits. Avoidance of ground movement entirely is not possible. The amount of movement that will occur cannot be accurately predicted mainly because the movements are more a function of excavation procedures and workmanship than they are of theoretical considerations.

3.3.1 Base Instability

Base instability is a concern for excavations in soft to firm clays. It is analogous to a bearing capacity failure, the difference being that stresses in the ground are relieved instead of increased. Two types of analysis are available for calculating the FS against base instability; the Terzaghi method and the Bjerrum & Eide method. The Terzaghi method is applicable for shallow and wide excavations. The variation of FS with excavation depth should be determined using the applicable method. Live loads such as surcharge loads due to traffic and construction equipment should be considered in this assessment.

The factor of safety against base instability in Lacustrine clay should be determined using the equation:

$$F_{sb} = (N_b S_u) / \sigma_z$$

Where:

F_{sb} = Factor of Safety with respect to base instability
 N_b = stability factor depending on the geometry of the excavation
 S_u = Undrained shear strength of the clay below base level
 σ_z = Total overburden pressure at base level

A minimum factor of safety of 1.50 is recommended for design purposes, using an undrained shear strength of 45 kPa and a bulk unit weight of 17.5 kN/m³ for the Lacustrine clay encountered in test hole TH13-01 at elevations between 234.2 m and 225.4 m. Where the FS falls below 1.50, wall movement is a concern as a result of yielding in the subsoil. The wall deformation could be reduced effectively where the depth of clay below the excavation base is limited and the wall is driven into a hard layer (i.e., till, dense sand).

4. Closing

The engineering design recommendations presented within this memorandum are based on the assumption that an adequate level of geotechnical monitoring will be provided during construction and that qualified contractors experienced in foundations and excavations will carry out the construction. An adequate level of geotechnical monitoring is considered to be regular monitoring of construction procedures and compaction testing for earthworks

If the conditions encountered during construction are different from the conditions reported in this memorandum or the conditions upon which the recommendations in this report are made, our office shall be contacted so that our recommendations can be reviewed and modified, if required.

AECOM requests the opportunity to review drawings and specifications related to this work or other designs based on the recommendations provided in this Memorandum to confirm that said recommendations have been correctly interpreted.

Should you require any further assistance, please do not hesitate to contact the undersigned.

Respectfully submitted,

A handwritten signature in blue ink, consisting of several overlapping, sweeping strokes that form a cursive, somewhat abstract shape.

Alex Hill, B.Sc. FGS
Geotechnical Engineering

Reviewed by:

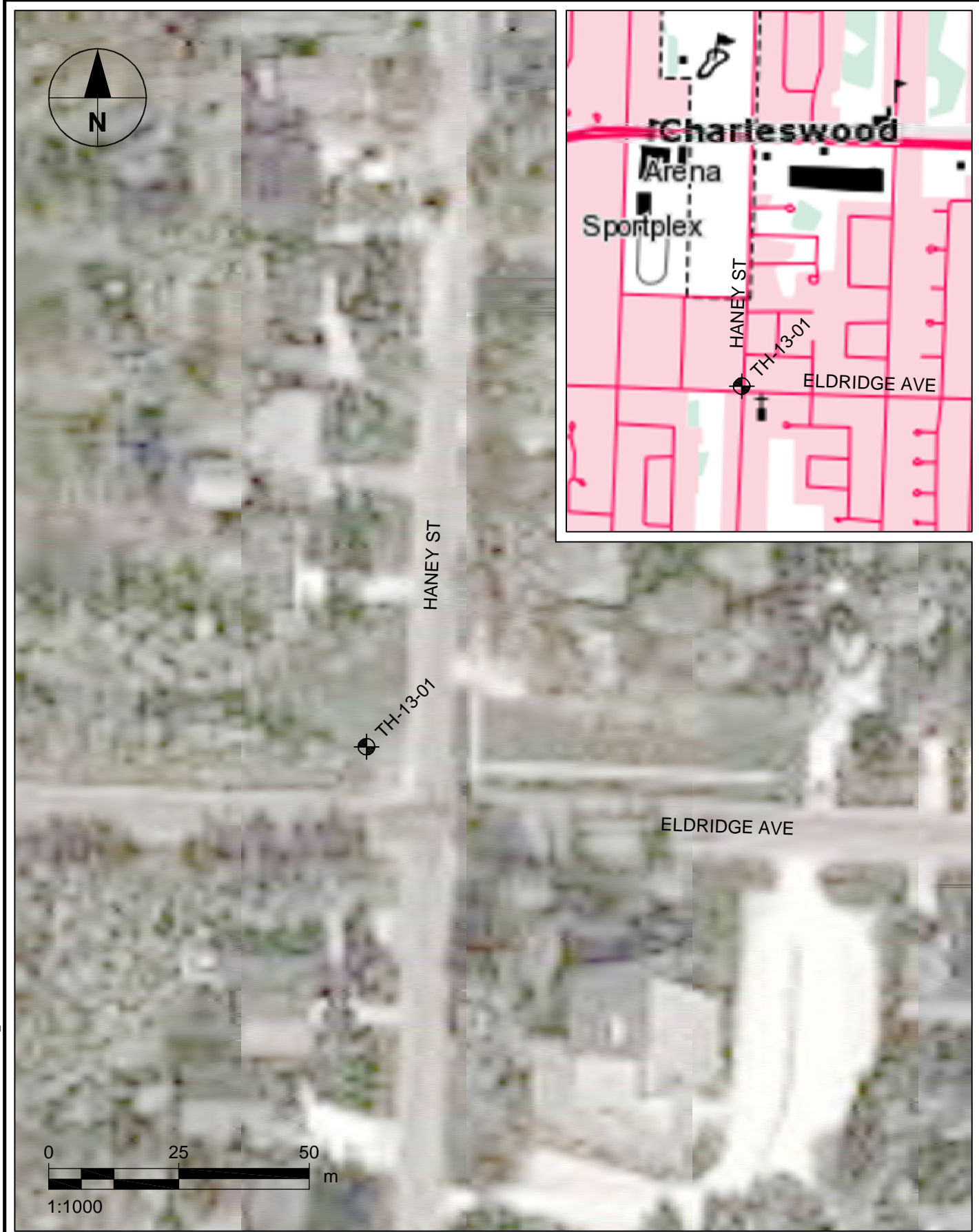
A handwritten signature in blue ink, featuring a large, open loop at the top and a vertical stroke with a horizontal crossbar at the bottom, resembling a stylized 'Z' or 'S'.

Zeyad Shukri, M.Sc.
Senior Geotechnical Engineer



Appendix A

Test Hole Location Plan



AECOM

Appendix B

Test Hole Logs

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

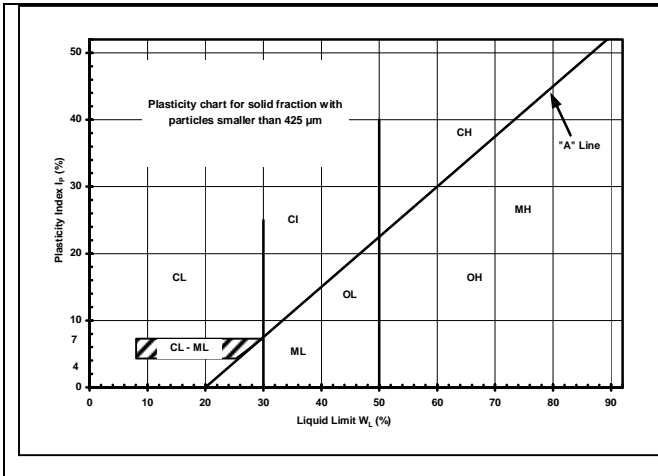
Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

Description			AECOM Log Symbols	USCS Classification	Laboratory Classification Criteria				
					Fines (%)	Grading	Plasticity	Notes	
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_u > 4$ $1 < C_c < 3$	Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4 < W_p < 7$ $C_u = \frac{D_{60}}{D_{10}}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$	
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12			Atterberg limits below "A" line or $W_p < 4$
			Clayey gravels, clayey sandy gravels		GC	> 12			Atterberg limits above "A" line or $W_p < 7$
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_u > 6$ $1 < C_c < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12			Atterberg limits below "A" line or $W_p < 4$
			Clayey sands, sand-clay mixtures		SC	> 12			Atterberg limits above "A" line or $W_p < 7$
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L < 50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML		Classification is Based upon Plasticity Chart		
		$W_L > 50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L < 30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30 < W_L < 50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L > 50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L < 50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L > 50$	Organic clays of high plasticity		OH				
	HIGHLY ORGANIC SOILS		Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	
	Asphalt		Till			AECOM			
	Concrete		Bedrock (Undifferentiated)						
	Fill		Bedrock (Limestone)						

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075		
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		10-20	some
				1-10	trace
* for example: gravelly, sandy clayey, silty					
Definition of Oversize Material					
COBBLES: 76mm to 300mm diameter					
BOULDERS: >300mm diameter					

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- qu - undrained shear strength (kPa) derived from unconfined compression testing.
- Tv - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- Lv - undrained shear strength (kPa) measured using a lab vane.
- Fv - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m³).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (WL, Wp)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

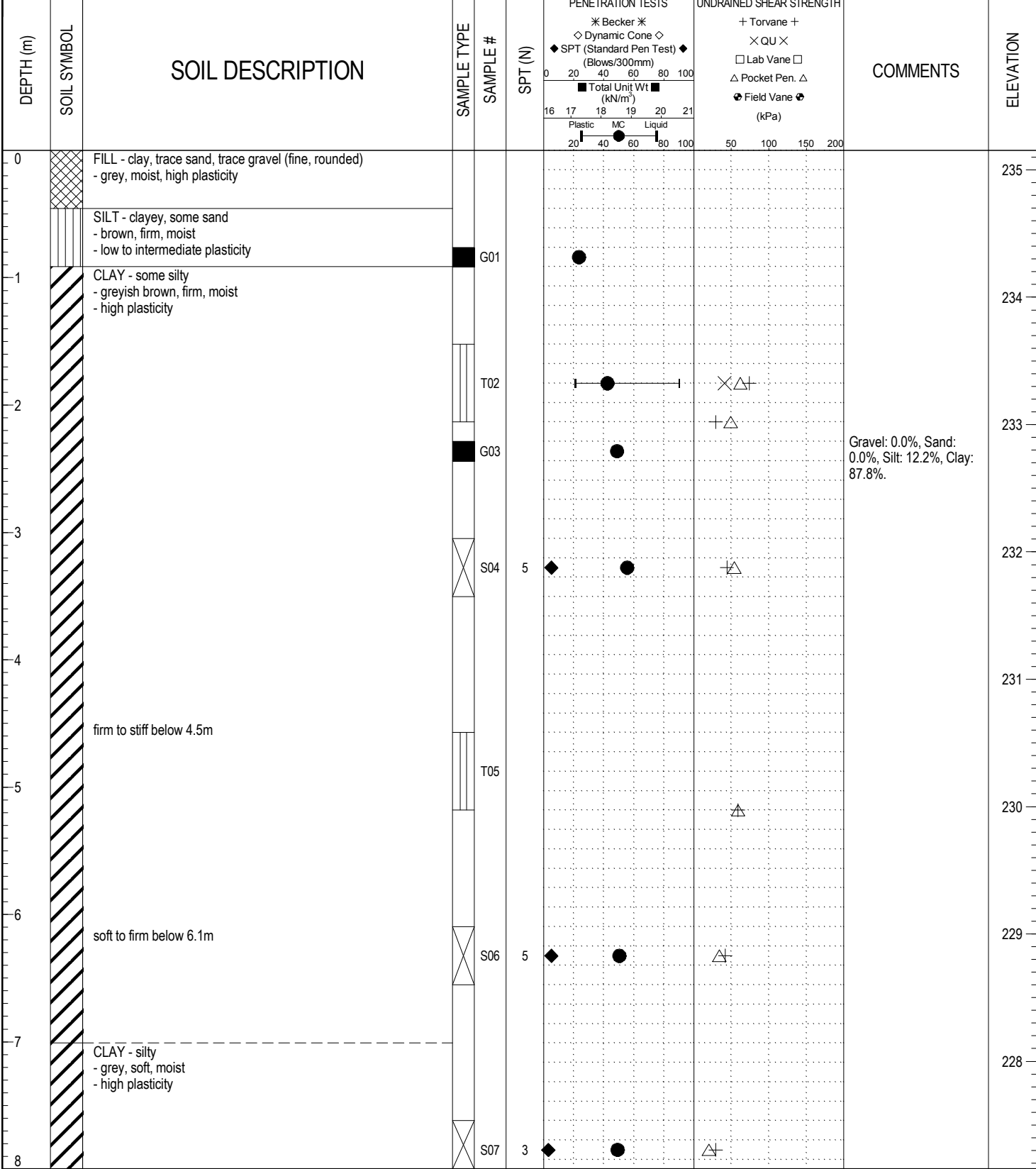
Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Eldridge & Haney Valve Chamber Upgrades CLIENT: City of Winnipeg TESTHOLE NO: TH13-01
 LOCATION: Northwest of Eldridge & Haney Intersection (0624616, 5523704) PROJECT NO.: 60297251
 CONTRACTOR: Maple Leaf Drilling Ltd. METHOD: Acker Renegade 125mm SSA ELEVATION (m): 235.15

SAMPLE TYPE GRAB SHELBY TUBE SPLIT SPOON BULK NO RECOVERY CORE



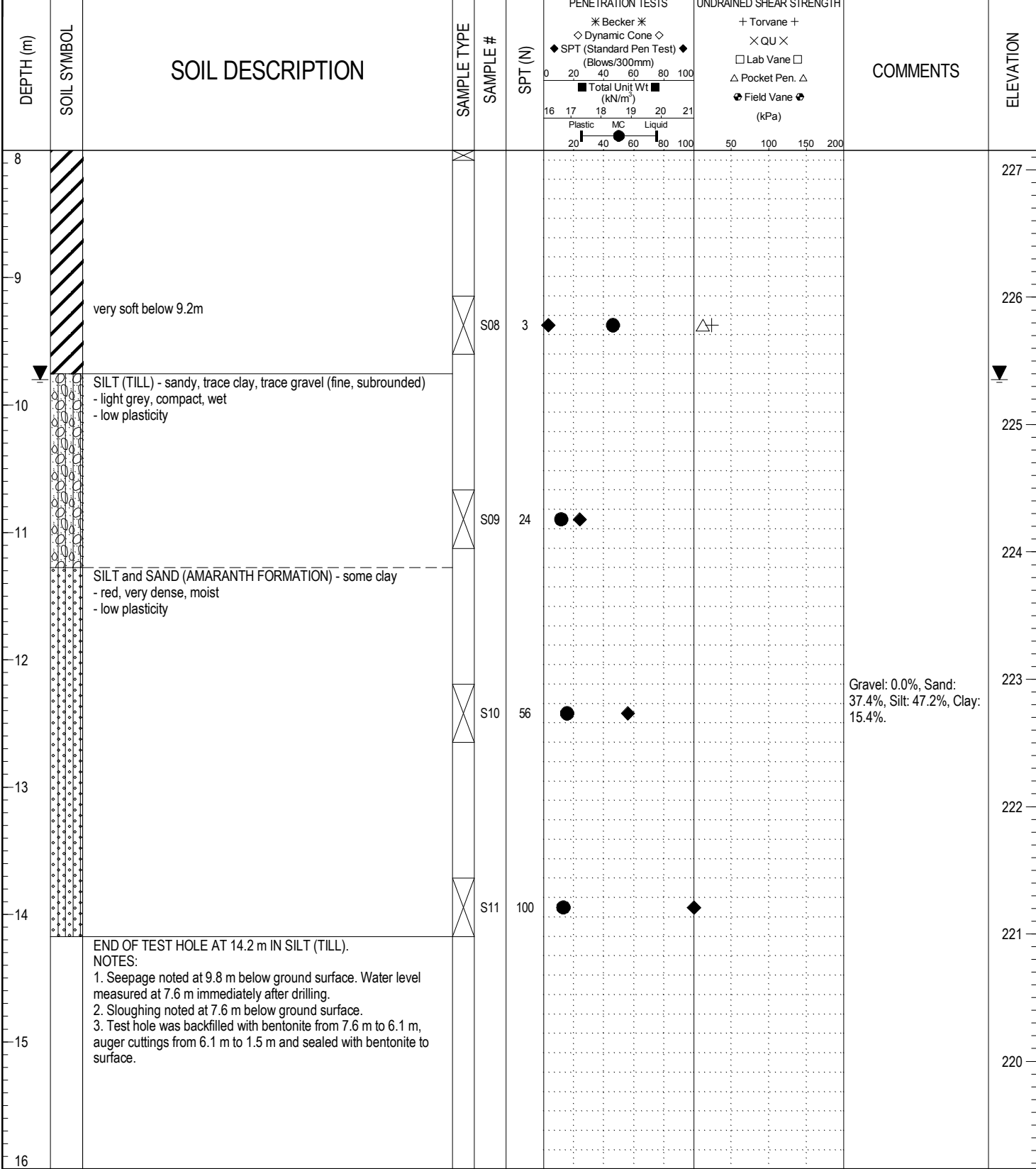
LOG OF TEST HOLE APRIL 2013 INVESTIGATION.GPJ UMA WINN.GDT 5/30/13



LOGGED BY: Aaron Kaluzniak COMPLETION DEPTH: 14.17 m
 REVIEWED BY: Alex Hill COMPLETION DATE: 4/26/13
 PROJECT ENGINEER: Marvin McDonald Page 1 of 2

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Appendix C

Existing Site and Chamber Photos



Figure 1 – Charleswood Feedermain Offtake Chamber



Figure 2 – Charleswood Feedermain Offtake Chamber - Piping



Figure 3 – Wilkes Ave Feedermain Offtake Chamber



Figure 4 – Wilkes Ave Feedermain Offtake Chamber – Piping



Figure 5 – Meter Pit