THE CITY OF WINNIPEG

BID OPPORTUNITY

BID OPPORTUNITY NO. 34-2006

WINNIPEG WATER TREATMENT PROGRAM – CONSTRUCTION OF DEWATERING CELLS

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PART B - BIDDING PROCEDURES

B1. PROJECT TITLE

B1.1 WINNIPEG WATER TREATMENT PROGRAM – CONSTRUCTION OF DEWATERING CELLS

B2. SUBMISSION DEADLINE

B2.1 The Submission Deadline is 12:00 noon Winnipeg time, April 12, 2006.

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

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

B3. SITE INVESTIGATION

B3.1 Further to GC:3.1, the Contract Administrator or an authorized representative will be available at the Site from 10:00 to 11:00 on March 28, 2006 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.

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. ADDENDA

B5.1 The Contract Administrator may, at any time prior to the Submission Deadline, issue addenda correcting errors, discrepancies or omissions in the Bid Opportunity, or clarifying the meaning or intent of any provision therein.

B5.2 The Contract Administrator will issue each addendum at least two (2) Business Days prior to the Submission Deadline, or provide at least two (2) Business Days by extending the Submission Deadline.

B5.2.1 Addenda will be available on the Bid Opportunities page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

B5.2.2 The Bidder is responsible for ensuring that he has received all addenda and is advised to check the Materials Management Branch internet site for addenda shortly before submitting his Bid.

B5.3 The Bidder shall acknowledge receipt of each addendum in Paragraph 10 of Form A: Bid. Failure to acknowledge receipt of an addendum may render a Bid non-responsive.

B6. SUBSTITUTES

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

B6.2 Substitutions shall not be allowed unless application has been made to and prior approval has been granted by the Contract Administrator in writing.

B6.3 Requests for approval of a substitute will not be considered unless received in writing by the Contract Administrator at least five (5) Business Days prior to the Submission Deadline.

B6.4 The Bidder shall ensure that any and all requests for approval of a substitute:

(a) provide sufficient information and details to enable the Contract Administrator to determine the acceptability of the Plant, Material or method as either an approved equal or alternative;

(b) identify any and all changes required in the applicable Work, and all changes to any other Work, which would become necessary to accommodate the substitute;

(c) identify any anticipated cost or time savings that may be associated with the substitute;

(d) certify that, in the case of a request for approval as an approved equal, the substitute will fully perform the functions called for by the general design, be of equal or superior substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance;

(e) certify that, in the case of a request for approval as an approved alternative, the substitute will adequately perform the functions called for by the general design, be similar in substance to that specified, is suited to the same use and capable of performing the same function as that specified and can be incorporated into the Work, strictly in accordance with the proposed work schedule and the dates specified in the Supplemental Conditions for Substantial Performance and Total Performance.

B6.5 The Contract Administrator, after assessing the request for approval of a substitute, may in his sole discretion grant approval for the use of a substitute as an “approved equal” or as an “approved alternative”, or may refuse to grant approval of the substitute.

B6.6 The Contract Administrator will provide a response in writing, at least two (2) Business Days prior to the Submission Deadline, only to the Bidder who requested approval of the substitute.

B6.6.1 The Bidder requesting and obtaining the approval of a substitute shall be entirely responsible for disseminating information regarding the approval to any person or persons he wishes to inform.

B6.7 If the Contract Administrator approves a substitute as an “approved equal”, any Bidder may use the approved equal in place of the specified item.

B6.8 If the Contract Administrator approves a substitute as an “approved alternative”, any Bidder bidding that approved alternative shall base his Total Bid Price upon the specified item but may also indicate an alternative price based upon the approved alternative. Such alternatives will be evaluated in accordance with B15.

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

B7. BID SUBMISSION

B7.1 The Bid Submission consists of the following components:

(a) Form A: Bid;

(b) Form B: Prices;

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

B7.2 All components of the Bid Submission shall be fully completed or provided, and submitted by the Bidder no later than the Submission Deadline, with all required entries made clearly and completely in ink, to constitute a responsive Bid.

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

B7.3.1 Samples or other components of the Bid Submission which cannot reasonably be enclosed in the envelope may be packaged separately, but shall be clearly marked with the Bid Opportunity number, the Bidder's name and address, and an indication that the contents are part of the Bidder’s Bid Submission.

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

B7.5 Bid Submissions shall be submitted to:

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

B8. BID

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

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

(a) if the Bidder is a sole proprietor carrying on business in his own name, his name shall be inserted;

(b) if the Bidder is a partnership, the full name of the partnership shall be inserted;

(c) if the Bidder is a corporation, the full name of the corporation shall be inserted;

(d) if the Bidder is carrying on business under a name other than his own, the business name and the name of every partner or corporation who is the owner of such business name shall be inserted.

B8.2.1 If a Bid is submitted jointly by two or more persons, each and all such persons shall identify themselves in accordance with B8.2.

B8.3 In Paragraph 3 of Form A: Bid, the Bidder shall identify a contact person who is authorized to represent the Bidder for purposes of the Bid.

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

(a) if the Bidder is a sole proprietor carrying on business in his own name, it shall be signed by the Bidder;

(b) if the Bidder is a partnership, it shall be signed by the partner or partners who have authority to sign for the partnership;

(c) if the Bidder is a corporation, it shall be signed by its duly authorized officer or officers and the corporate seal, if the corporation has one, should be affixed;

(d) if the Bidder is carrying on business under a name other than his own, it shall be signed by the registered owner of the business name, or by the registered owner's authorized officials if the owner is a partnership or a corporation.

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

B8.4.2 All signatures shall be original and shall be witnessed except where a corporate seal has been affixed.

B8.5 If a Bid is submitted jointly by two or more persons, the word "Bidder" shall mean each and all such persons, and the undertakings, covenants and obligations of such joint Bidders in the Bid Submission and the Contract, when awarded, shall be both joint and several.

B9. PRICES

B9.1 The Bidder shall state a price in Canadian funds for each item of the Work identified on Form B: Prices.

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

B9.3 The quantities for which payment will be made to the Contractor are to be determined by the Work actually performed and completed by the Contractor, to be measured as specified in the applicable Specifications.

B10. QUALIFICATION

B10.1 The Bidder shall:

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

(b) be responsible and not be suspended, debarred or in default of any obligation to the City;

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

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

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

(f) employ only Subcontractors who:

(i) are responsible and not suspended, debarred or in default of any obligation to the City (a list of suspended or debarred individuals and companies is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt); and

(ii) have successfully carried out work similar in nature, scope and value to the portion of the Work proposed to be subcontracted to them, and are fully capable of performing the Work required to be done in accordance with the terms of the Contract;

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

B10.2 Further to B10.1(g), the Bidder shall, within three (3) Business Days of a request by the Contract Administrator, provide proof satisfactory to the Contract Administrator that the Bidder has a workplace safety and health program meeting the requirements of The Workplace Safety and Health Act (Manitoba), by providing:

(a) a valid COR certification number under the Certificate of Recognition (COR) Program - Option 1 administered by the Manitoba Heavy Construction Association's Safety, Health and Environment Program; or

(b) a valid COR certification number under the Certificate of Recognition (COR) Program administered by the Manitoba Construction Safety Association; or

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

B10.3 The Bidder shall be prepared to submit, within three (3) Business Days of a request by the Contract Administrator, proof satisfactory to the Contract Administrator of the qualifications of the Bidder and of any proposed Subcontractor.

B10.4 The Bidder shall provide, on the request of the Contract Administrator, full access to any of the Bidder's equipment and facilities to confirm, to the Contract Administrator's satisfaction, that the Bidder's equipment and facilities are adequate to perform the Work.

B11. BID SECURITY

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

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

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

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

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

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

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

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

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

B12. OPENING OF BIDS AND RELEASE OF INFORMATION

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

B12.1.1 Bidders or their representatives may attend.

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

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

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

B12.4 The Bidder is advised that any information contained in any Bid Submission may be released if required by City policy or procedures, by The Freedom of Information and Protection of Privacy Act (Manitoba), by other authorities having jurisdiction, or by law.

B13. IRREVOCABLE BID

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

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

B14. WITHDRAWAL OF BIDS

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

B14.1.1 Notwithstanding GC:23.3, the time and date of receipt of any notice withdrawing a Bid shall be the time and date of receipt as determined by the Manager of Materials.

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

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

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

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

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

B14.2 A Bidder who withdraws his Bid after the Submission Deadline but before his Bid has been released or has lapsed as provided for in B13.2 shall be liable for such damages as are imposed upon the Bidder by law and subject to such sanctions as the Chief Administrative Officer considers appropriate in the circumstances. The City, in such event, shall be entitled to all rights and remedies available to it at law, including the right to retain the Bidder's bid security.

B15. EVALUATION OF BIDS

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

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

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

(c) Total Bid Price;

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

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

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

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

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

B16. AWARD OF CONTRACT

B16.1 The City will give notice of the award of the Contract by way of a letter of intent, or will give notice that no award will be made.

B16.2 The City will have no obligation to award a Contract to a Bidder, even though one or all of the Bidders are determined to be responsible and qualified, and the Bids are determined to be responsive.

B16.2.1 Without limiting the generality of B16.2, the City will have no obligation to award a Contract where:

(a) the prices exceed the available City funds for the Work;

(b) the prices are materially in excess of the prices received for similar work in the past;

(c) the prices are materially in excess of the City's cost to perform the Work, or a significant portion thereof, with its own forces;

(d) only one Bid is received; or

(e) in the judgment of the Award Authority, the interests of the City would best be served by not awarding a Contract.

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

PART C - GENERAL CONDITIONS

C1. GENERAL CONDITIONS

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

C1.1.1 The *General Conditions for Construction Contracts* are available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

PART D - SUPPLEMENTAL CONDITIONS

GENERAL

D1. GENERAL CONDITIONS

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

D1.2 The General Conditions are amended by striking out “The City of Winnipeg Act” wherever it appears in the General Conditions and substituting “The City of Winnipeg Charter”.

D1.3 The General Conditions are amended by striking out “Tender Package” wherever it appears in the General Conditions and substituting “Bid Opportunity”.

D1.4 The General Conditions are amended by striking out “Tender Submission” wherever it appears in the General Conditions and substituting “Bid Submission”.

D1.5 The General Conditions are amended by deleting GC:6.16 and GC:6.17. The City of Winnipeg is now within the jurisdiction of the Manitoba Ombudsman pursuant to The Ombudsman Act.

D2. SCOPE OF WORK

D2.1 The Work to be done under the Contract shall consist of the construction of four dewatering cells and associated infrastructure.

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

D2.2.1 Excavation, haulage, placement and compaction for construction of four (4) dewatering cells with clay liner.

D2.2.2 Construction of dewatering cell infrastructure as shown on the Drawings and Specifications, including (but not limited to):

(a) gravel dewatering cell base with geotextile layer

(b) rip rap covering for berms with geotextile layer;

(c) subdrain pipe trenches with geotextile layer;

(d) roadways and fencing as shown on the Drawings;

(e) dewatering cell subdrain piping, influent piping, influent piping isolation valves, inter-cell overflow piping and manholes with interconnecting manhole piping;

(f) Forcemains and sludge piping systems to the contract limits as shown on the Drawings.

(g) Construction of dewatering pump station, metering chamber, decant structures and the foundation and slab for the future pad mounted electrical distribution.

(h) Supply and installation of sluice gates.

(i) Performance Verification in accordance with the Specifications for the dewatering cells, valves, sluice gates and all other items as specified. Prior to Total Performance, the Dewatering Cells shall be filled with water to an elevation of 239.5 meters.

(j) Mechanical:

(i) Supply and installation of mechanical wall embeds in the dewatering pump station up to and including the first flange on either side of the concrete wall and any weldolets or other appurtenances as shown on the embedded pipe.

(ii) Supply and installation of screened air vents for the dewatering pump station

(iii) Supply and installation of mechanical wall embeds in the metering chamber up to and including the first flange on either side of the concrete wall and any weldolets or other appurtenances as shown on the embedded pipe.

(iv) The supply and installation of all other mechanical piping and equipment located in the dewatering pump station and the metering chamber will be by others.

(k) Electrical:

(i) Supply and installation of 600V interlocked receptacles and four conductor #10 Teck cables from the future power distribution (see detail A/WL-E0110 and drawing WL-E-0112) to serve the decant structures. Terminate conductors at each receptacle and leave a 10m coil for each Teck cable at the electrical distribution foundation for the City's future use.

(ii) Supply and installation of two 75 mm electrical conduit embeds in the dewatering pump station and metering chamber walls.

(iii) The supply and installation of all other electrical and I&C equipment will be by others including pole mounted luminaire, electrical distribution equipment and service from the DBPS.

(l) All work to be done other than excavation, haulage, placement, and compaction is included in D2.2.2.

D3. DEFINITIONS

D3.1 When used in this Bid Opportunity:

(a) "**Freeze Thaw Pond**" means dewatering cell;

(b) **HDPE** means high density polyethylene;

(c) **GWWD** means Greater Winnipeg Water District; and

(d) **DBPS** means Deacon Booster Pumping Station

(e) **DFO** means the Federal Department of Fisheries and Oceans

(f) **HIS** means Hydraulic Institute Standards

(g) **ANSI** means American National Standards Institute

(h) **ASME** means American Society of Mechanical Engineers

(i) **ASTM** means American Society for Testing and Materials

(j) **AWWA** means American Water Works Association

(k) **CSA** means Canadian Standards Association

(l) **DAF** means Dissolved Air Flotation

(m) **IEC** means International Electrotechnical Commission

(n) **ISO** means International Organization for Standardization

(o) **NACE** means National Association of Corrosion Engineers

(p) **NEMA** means National Electrical Manufacturers Association

(q) **NSF** means National Sanitation Foundation

(r) **SAE** means Society of Automotive Engineers

(s) **Manufacturer** means the person, partnership or corporation responsible for the manufacture and fabrication of equipment supplied by the Contractor to the City for the completion of the Work.

(t) **Manufacturer's Representative** means a trained serviceman empowered by the Manufacturer to provide installation, testing, and commissioning assistance to the City in his performance of those functions.

(u) **IEEE** means Institute of Electrical and Electronics Engineers

(v) **NEMA** means National Electrical Manufacturer's Association

(w) **Furnish** means supply

(x) **ISA** means the Instrumentation Systems and Automation Society

(y) **Total Performance** means that the entire Work, except those items arising from the Provision of GC.10.01 have been performed in accordance with this Contract

(z) **AGMA** means American Gear Manufacturer's Association.

(aa) **API** means American Petroleum Institute

(bb) **EEMAC** means Electrical and Electronic Manufacturer of Canada

(cc) **VFD** means variable frequency drive

(dd) **VSD** means variable speed drive

(ee) **TPSH** means twisted pair shielded cable

(ff) **RTD** means resistance temperature detector

(gg) **SHG** means sodium hypochlorite generation

(hh) **Contract Work Schedule** means a Gantt Charter developed by the Contractor developed using the critical path method which shows the proposed progress of the major items of work which are to be performed under this Contract

(ii) **Project Master Schedule** means a schedule developed by the Contract Administrator which includes and coordinates the Contract Work Schedules of several City contracts, including this Contract

(jj) **Professional Engineer** means a professional engineer registered in the Province of Manitoba.

(kk) **Major Equipment** means all equipment for which shop drawing submittals are required as specified herein.

(ll) **Performance Verification** means all factory and field tests, demonstrations and other activities required from the Contractor to complete all required Forms 103 – Certificate of Satisfactory Performance and to demonstrate to the Contract Administrator's satisfaction that the equipment installed under this Contract is performing as specified herein.

(mm) **Certified Shop Drawings** means Shop Drawings prepared by the Contractor after all required Shop Drawings have been "reviewed" or "reviewed as modified" in accordance with Section 01300 of this Bid Opportunity and which incorporate all modifications to the Shop Drawings, comments and notations made by the Contract Administrator in the course of the review.

(nn) **Record Drawings** means a minimum of one (1) complete set of Contract Documents and Certified Shop Drawings maintained at the Contractor's Site office on which the Contractor clearly shall clearly record in red pencil all Addenda, Change Orders, Field Instructions, and other revisions or as-built conditions which deviate from the original Contract Documents or Certified Shop Drawings.

(oo) **Acceptable Shop Drawings** means all required Shop Drawings have been reviewed by the Contract Administrator and have been annotated and stamped as "reviewed" or "reviewed as modified" in accordance with Section 01300 of this Bid Opportunity

(pp) **Control System Integrator** means a contractor retained by the City (under a different contract) to program and configure the water treatment plant SCADA system.

(qq) **Systems Integrator** means Control Systems Integrator.

(rr) **SCADA** means supervisor control and data acquisition.

(ss) **TGS** means Manitoba Transportation and Government Service.

(tt) **MV** means medium voltage**.**

(uu) **WTP** means the Winnipeg Water Treatment Plant and includes the structure and all equipment and materials supplied and installed into the building, under multiple construction contracts, including portions of the Work provided under this Contract.

(vv) **City Warehouse** means the enclosed and heated City owned warehouse located at 1500 Plessis Road, Winnipeg, Manitoba.

(ww) **O&M** means operation and maintenance

(xx) **I&C** means instrumentation and control

(yy) **AASHTO** means American Association of State Highway and Transportation Officials

(zz) **UV** means ultraviolet

(aaa) **PVC** means polyvinyl chloride

(bbb) **ULC** means Underwriter's Laboratories of Canada

(ccc) **Topsoil** means organic clay/material capable of supporting good vegetation growth and suitable for use in top dressing, landscaping, and seeding.

(ddd) **ASHRAE** means American Society of Heating, Refrigerating, and Air Conditioning Engineers

(eee) **AWS** means American Welding Society

(fff) **NFPA** means National Fire Protection Association

(ggg) **OSHA** means Occupational Safety and Health Act

(hhh) **FS** means Federal Specifications

(iii) **AFBMA** means Anti-Friction Bearing Manufacturer's Association

(jjj) **NACE** means National Association of Corrosion Engineers

(kkk) **PLC** means programmable logic controller

(lll) **I/O** means input/output

(mmm) **UHMWPE** means ultra high molecular weight polyethylene

(nnn) **NPSH** means net positive suction head

(ooo) **NPSHR** means net positive suction head required

(ppp) **TEFC** means totally enclosed fan-cooled

(qqq) **ABMA** means American Bearing Manufacturer's Association

(rrr) **BEP** means best efficiency point

(sss) **PTC** means positive thermal protection

(ttt) **ODP** means open drip proof

(uuu) **CEMA** means Canadian Electrical Manufacturer's Association

(vvv) **TDH** means total dynamic head

(www) **SSPC** means Steel Structures Painting Council

(xxx) **P&ID** means piping and instrumentation diagram

(yyy) **ILD** means instrument loop diagram

(zzz) **HMI** means human machine interface

(aaaa) **UPS** means uninterruptible power supply

(bbbb) **MCC** means motor control centre

D3.2 The definitions of technical terms, abbreviations, and symbols will be those of the American Society for Testing and Materials, Canadian Standards Association and the applicable Codes and Standards. In the event of a dispute, the Contract Administrator's decision will be final.

D3.3 The Manufacturer and Manufacturer's Representative are not parties to this Contract. All work required from the Manufacturer and Manufacturer's Representative shall be provided and coordinated by the Contractor.

D3.4 Terms related to excavation, haulage and placement of earth shall be as defined in Section 02661.

D4. CONTRACT ADMINISTRATOR

D4.1 The Contract Administrator is UMA Projects (CM) Ltd., represented by:

Lawrence Recksiedler, C.E.T.
Deacon Reservoir WTP Project Offices
RM of Springfield

Telephone No. (204) 986-4246
Facsimile No. (204) 986-8393

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

D5. CONTRACTOR'S SUPERVISOR

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

D6. NOTICES

D6.1 Except as provided for in GC:23.2.2, all notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the Contractor shall be sent to the address or facsimile number identified by the Contractor in Paragraph 2 of Form A: Bid.

D6.2 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications to the City, except as expressly otherwise required in D6.3, D6.4 or elsewhere in the Contract, shall be sent to the attention of the Contract Administrator at the address or facsimile number identified in D4.1.

D6.3 All notices of appeal to the Chief Administrative Officer shall be sent to the following address or facsimile number:

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

Facsimile No.: (204) 949-1174

D6.4 All notices, requests, nominations, proposals, consents, approvals, statements, authorizations, documents or other communications required to be submitted or returned to the City Solicitor shall be sent to the following address or facsimile number:

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

Facsimile No.: (204) 947-9155

D7. FURNISHING OF DOCUMENTS

D7.1 Upon award of the Contract, the Contractor will be provided with five (5) complete sets of the Bid Opportunity. If the Contractor requires additional sets of the Bid Opportunity, they will be supplied to him at cost.

SUBMISSIONS

D8. SAFE WORK PLAN

D8.1 The Contractor shall provide the Contract Administrator with a Safe Work Plan at least five (5) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

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

D9. INSURANCE

D9.1 The City will provide and maintain the following Project Insurance Coverages:

(a) Builder's Risk Insurance in the amount of one hundred percent (100%) of the total project cost.

(i) The Contractor shall be responsible for deductibles up to $10,000.00 maximum of any one loss.

(b) Wrap-Up Liability Insurance in an amount of no less than 10 million dollars ($10,000,000.00)

(i) The Contractor shall be responsible for deductibles up to $10,000.00 maximum of any one loss.

(c) The City of Winnipeg will carry such insurance to cover all parties engaged in the Work in this Contract. Provision of this insurance by the City of Winnipeg is not intended in any way to relieve the Contractor from his obligations under the terms of the Contract. Specifically, losses relating to deductibles for insurance, as well as losses in excess of limits of coverage and any risk of loss that is not covered under the terms of the insurance provided by the City of Winnipeg remains with the Contractor.

D9.2 The Contractor shall provide and maintain the following insurance coverage at all times during the performance of the Work:

(a) Automobile liability insurance for owned and non-owned automobiles used for or in connection with the work in the amount of at least two million dollars ($2,000,000.00).

(i) Deductibles shall be borne by the Contractor;

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

(iii) The Contractor shall provide the Contract Administrator with evidence of insurance of the policy at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than seven (7) Calendar Days from notification of the award of Contract.

D9.3 The Contractor shall not cancel, materially alter, or cause each policy to lapse without providing at least fifteen (15) Calendar Days prior written notice to the Contract Administrator.

D10. WORK SCHEDULE

D10.1 The Contract Administrator has developed a Project Master Schedule for the project. This schedule will be available in the offices of the Contract Administrator and will be updated as required as the work progresses.

D10.2 The Contractor shall, within 5 business days of award of contract, prepare a detailed Contract Work Schedule for his work based on a critical path method (CPM) approach.

D10.3 The schedule shall conform to the Project Master Schedule and show, in a clear graphical manner, through the use of Gantt charts, in a maximum of weekly stages, the proposed progress of the main items, structures and subtrades of the contract and indicate the labour, construction crews, plant and equipment to be employed. Indicate the delivery date of major pieces of equipment to be supplied. The schedule shall be predicated on the completion of all work on or before the date of Substantial Performance.

D10.4 Upon acceptance by the Contract Administrator, distribute copies of the revised schedule to Subcontractors and other concerned parties.

D10.5 The Contract Work Schedule shall be updated as the work requires and submitted to the Contract Administrator.

D10.6 The Contractor shall instruct recipients to report to the Contractor immediately any problems anticipated by the timetable shown in the Contract Work Schedule.

D10.7 While it is intended that the Contractor shall be allowed, in general, to carry on the Contract in accordance with such general plans as may appear to him to be most desirable, the Contract Administrator, at his discretion, may direct the order in which, and points at which, the work shall be undertaken.

D10.8 This control shall be exercised in the interests of the City so that the work or other Contractors who may be working on the site may be coordinated with the work on this Contract. A program of work will be drawn up and agreed to before the commencement of the Contract.

D10.9 The Contract Administrator shall be notified immediately when the work under the Contract Work Schedule will adversely affect the work of other Contractors and the critical path of the Project Master Schedule as the work under the Contractor's Contract Work Schedule is an integral part of the Project Master Schedule.

D11. PERFORMANCE SECURITY

D11.1 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.

D11.1.1 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.

D11.2 If the bid security provided in his Bid Submission was not a certified cheque or draft pursuant to B11.1(c), the Contractor shall provide the City Solicitor with the required performance security within seven (7) Calendar Days of notification of the award of the Contract by way of letter of intent and prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

D12. DETAILED PRICES

D12.1 The Contractor shall provide the Contract Administrator with a detailed price breakdown in a format acceptable to the Contract Administrator at least two (2) Business Days prior to the commencement of any Work on the Site but in no event later than the date specified in GC:4.1 for the return of the executed Contract.

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 the General Conditions for the return of the executed Contract.

D14. SECURITY CLEARANCE

D14.1 Each individual proposed to perform the following portions of the Work:

(a) within the restricted access area of the DBPS compound.

shall be required to obtain a Criminal Record Search Certificate from the police service having jurisdiction at his place of residence.

D14.2 Prior to the commencement of any Work, 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 Work within City facilities or on private property.

D14.3 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 within City facilities or on private property.

D14.4 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.

D14.5 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 Work under the Contract within City facilities or on private property.

SCHEDULE OF WORK

D15. COMMENCEMENT

D15.1 The Contractor shall not commence any Work until he is in receipt of a letter of intent from the Award Authority authorizing the commencement of the Work.

D15.2 The Contractor shall not commence any Work on the Site until:

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

(i) evidence that the Contractor is in good standing under The Corporations Act (Manitoba), or properly registered under The Business Names Registration Act (Manitoba), or otherwise properly registered, licensed or permitted by law to carry on business in Manitoba;

(ii) evidence of the workers compensation coverage specified in GC:6.14;

(iii) the Safe Work Plan specified in D8;

(iv) evidence of the insurance specified in D9;

(v) the Contract Work Schedule specified in D10;

(vi) the performance security specified in D11;

(vii) the detailed price breakdown specified in D12;

(viii) the Subcontractor list specified in D13; and

(ix) the security clearances specified in D14.

(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.

D15.3 The Contractor shall commence the Work on the Site within seven (7) Working Days of receipt of the letter of intent.

D16. SUBSTANTIAL PERFORMANCE

D16.1 The Contractor shall achieve Substantial Performance by June 30, 2007.

D16.2 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.

D16.3 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.

D17. TOTAL PERFORMANCE

D17.1 The Contractor shall achieve Total Performance by July 31, 2007.

D17.2 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.

D17.3 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.

D18. LIQUIDATED DAMAGES

D18.1 If the Contractor fails to achieve Substantial Performance or Total Performance in accordance with the Contract by the days fixed herein for same, the Contractor shall pay the City the following amounts per Calendar Day for each and every Calendar Day following the days fixed herein for same during which such failure continues:

(a) Substantial Performance – two thousand, six hundred dollars ($2,600.00);

(b) Total Performance – six hundred dollars ($600.00).

D18.2 The amount specified for liquidated damages in D18.1 is based on a genuine pre-estimate of the City's losses in the event that the Contractor does not achieve Total Performance by the day fixed herein for same.

D18.3 The City may reduce any payment to the Contractor by the amount of any liquidated damages assessed.

D18.4 The City will not pay a bonus if the Contractor reaches Substantial Performance or Total Performance earlier than the dates specified herein.

CONTROL OF WORK

D19. JOB MEETINGS

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

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

D20. PRIME CONTRACTOR – THE WORKPLACE SAFETY AND HEALTH ACT (MANITOBA)

D20.1 Further to GC6.26, UMA Projects (CM) Ltd. 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).

D20.2 As Prime Contractor, UMA Projects (CM) Ltd. will administer a Project Safety and Health Management Plan. Compliance with this Plan will be mandatory for all personnel on the construction site and training and certification of all staff by the Prime Contractor's Safety Officer will be required.

D20.3 The Water Treatment Program Project Health and Safety Management Plan is available on the City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt/projects

MEASUREMENT AND PAYMENT

D21. PAYMENT SCHEDULE

D21.1 Further to GC:12, payment shall be in accordance with the following payment schedule:

(a) Measurement and payment for item 1 on Form B: Prices will be made at the Contract Unit Price and as follows:

(i) Excavation will be measured on a volume basis. The amount measured shall be the total number of cubic meters of soil removed, and acceptably placed and compacted in accordance with the Specifications, as determined by the Contract Administrator.

(ii) No measurement will be made for areas excavated outside of the limits specified. All measurements will be performed using prismoidal volume models instead of average end areas.

(b) The unit price listed for item 2 in Form B: Prices will be paid on the basis of monthly progress estimates in accordance with GC:12 and the detailed price breakdown prepared pursuant to D12.

FORM H1: PERFORMANCE BOND
(See D11)

KNOW ALL MEN BY THESE PRESENTS THAT

_____
(hereinafter called the "Principal"), and

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

_____

_____ dollars ($_____.____)

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

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

_____ day of _____ , 20____ , for:

BID OPPORTUNITY NO. 34-2006

WINNIPEG WATER TREATMENT PROGRAM – CONSTRUCTION OF DEWATERING CELLS

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

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

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

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

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

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

_____ day of _____ , 20____ .

SIGNED AND SEALED
in the presence of:

_____
(Witness)

_____
(Name of Principal)

Per: _____ (Seal)

Per: _____

_____
(Name of Surety)

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

FORM H2: IRREVOCABLE STANDBY LETTER OF CREDIT
(PERFORMANCE SECURITY)
(See D11)

_____
(Date)

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

RE: PERFORMANCE SECURITY - BID OPPORTUNITY NO. 34-2006

WINNIPEG WATER TREATMENT PROGRAM – CONSTRUCTION OF DEWATERING CELLS

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

_____ ,
(Name of Contractor)

_____
(Address of Contractor)

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

_____

_____ Canadian dollars.

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

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

Partial drawings are permitted.

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

_____
(Address)

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

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

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

_____ .
(Date)

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

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

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

_____
(Name of bank or financial institution)

Per: _____
(Authorized Signing Officer)

Per: _____
(Authorized Signing Officer)

FORM J: SUBCONTRACTOR LIST
(See D13)

WINNIPEG WATER TREATMENT PROGRAM – CONSTRUCTION OF DEWATERING CELLS

Name	Address

PART E - SPECIFICATIONS

GENERAL

E1. APPLICABLE SPECIFICATIONS, STANDARD DETAILS AND DRAWINGS

E1.1 *The City of Winnipeg Standard Construction Specifications* in its entirety, whether or not specifically listed on Form B: Prices, shall apply to the Work.

E1.1.1 *The City of Winnipeg Standard Construction Specifications* is available on the Information Connection page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt.

E1.1.2 The version in effect three (3) Business Days before the Submission Deadline shall apply.

E1.1.3 Further to GC:2.4(d), Specifications included in the Bid Opportunity shall govern over *The City of Winnipeg Standard Construction Specifications*.

E1.2 The Specifications reference specifications and standards published by CSA and CGSB, which shall apply to the Work.

E1.2.1 The version in effect three (3) Business Days before the Submission Deadline shall apply.

E1.3 The following Specifications are applicable to the Work:

Section	Title
Division 01	
01300	Submittals
01400	Quality Control
01650	Equipment Installation
01730	Operation and Maintenance Manuals
Division 02	
02223	Excavation and Backfilling for Structures
02226	Drain Pipes
02362	Bored Cast-in-Place Concrete Piles
02371	Supply and Placement of Rip Rap
02531	Forcemains
02620	Subdrains
02650	Preservation of Topsoil
02651	Topsoil, Mulching & Seeding
02661	Excavation, Haulage, and Placement
Division 03	
03100	Concrete Formwork
03200	Concrete Reinforcement
03250	Concrete Accessories
03300	Cast-in-Place Concrete
03412	Precast Concrete Walkway Panels
Division 05	
05530	Aluminum Fabrications
Division 07	
07212	Rigid Wall Insulation

Section	Title
Division 11	
11000	Equipment General Provisions
11290	Sluice Gate
11900	Field-Applied Corrosion Protection and Maintenance Coatings
11901	Factory Applied Maintenance and Corrosion Protection Coatings
11910	Identification
Division 16	
16010	Electrical General Requirements
16106	Installation of Cables in Trenches and in Ducts
16111	Conduits, Conduit Fastenings and Conduit Fittings
16122	Wires and Cable 0-1000 V
16132	Outlet Boxes, Conduit Boxes and Fittings
16141	Wiring Devices
16151	Wire and Box Connectors 0-1000 V
16191	Fastenings and Supports
16980	Testing, Adjusting and Balancing of Electrical Equipment and Systems

E1.4 The following Drawings are applicable to the Work:

Consultant Drawing No.	City Drawing No.	Drawing Title
WL-C0100	1-0601L-A-C0100-001-00D	Civil – Overall Layout
WL-C0101	1-0601L-A-C0101-001-00D	Civil – Cell 1 Plan View
WL-C0102	1-0601L-A-C0102-001-00D	Civil – Cell 2 Plan View
WL-C0103	1-0601L-A-C0103-001-00D	Civil – Cell 3 Plan View
WL-C0104	1-0601L-A-C0104-001-00D	Civil – Cell 4 Plan View
WL-C0105	1-0601L-A-C0105-001-00D	Civil – Subdrain and Inlet Systems – Sections and Details
WL-C0110	1-0601L-A-C0110-001-00D	Civil – Decant Systems – Plan / Profile
WL-C0201	1-0601L-A-C0201-001-00D	Civil – Sections – Sheet 1
WL-C0202	1-0601L-A-C0202-001-00D	Civil – Sections – Sheet 2
WL-C0405	1-0601L-A-C0405-001-00D	Civil – Dewatering Pump Station – Plan, Sections and Details
WL-C0450	1-0601L-A-C0450-001-00D	Civil – Miscellaneous Details
WL-C0452	1-0601L-A-C0452-001-00D	Civil – Standard Details – Sheet 2
WL-C0454	1-0601L-A-C0454-001-00D	Civil – Standard Details – Sheet 4
WL-C0455	1-0601L-A-C0455-001-00D	Civil – Standard Details – Sheet 5
WL-C0456	1-0601L-A-C0456-001-00D	Civil – Standard Details – Sheet 6
WL-E0110	1-0601L-A-E0110-001-00D	Electrical – Decant Systems – Plans and Details
WL-E0111	1-0601L-A-E0111-001-00D	Electrical – Decant Systems – Sections and Details
WL-E0112	1-0601L-A-E0112-001-00D	Electrical – Decant Systems – Details and Schedules
WL-S0100	1-0601L-A-S0100-001-00D	Structural – Metering Chamber – Plans, Sections and Details
WL-S0101	1-0601L-A-S0101-001-00D	Structural – Decant Structure – Foundation Plans, Sections and Details
WL-S0102	1-0601L-A-S0102-001-00D	Structural – Power Distribution Enclosure – Conc. Pad, Plan and Sections / Detail
WL-S0103	1-0601L-A-S0103-001-00D	Structural – Dewatering Pump Station – FTG Plan, FDN Plan, Platform & Cover Plan
WL-S0104	1-0601L-A-S0104-001-00D	Structural – Dewatering Pump Station – Sections and Details
WL-S0105	1-0601L-A-S0105-001-00D	Structural – General Notes
WL-A0401	1-0601L-D-A0401-001-00D	Automation I&C – Ultrasonic Level Transducer – Instrumentation Standard Details
WL-A0402	1-0601L-D-A0402-001-00D	Automation I&C – Loop Powered Remote Indicating Transmitter – Instrumentation Standard Details

WL-A0403	1-0601L-D-A0403-001-00D	Automation I&C – Turbitity / TSS Sensor – Instrumentation Standard Details
WL-C0400	1-0601L-D-C0400-001-00D	Civil – Granular Structures Plan
WL-C0401	1-0601L-D-C0401-001-00D	Civil – Road Geometry and Grading Details – Part Plan Sheet 1
WL-C0402	1-0601L-D-C0402-001-00D	Civil – Road Geometry and Grading Details – Part Plan Sheet 2
WL-C0403	1-0601L-D-C0403-001-00D	Civil – Road Geometry and Grading Details – Part Plan Sheet 3
WL-C0404	1-0601L-D-C0404-001-00D	Civil – Earth Removal Plan
WL-C0600	1-0601L-D-C0600-001-00D	Civil – Survey Control Plan
WL-P0003	1-0601L-D-P0003-001-00D	Construction Standards – Process and Instrumentation - Identification
WL-P0004	1-0601L-D-P0004-001-00D	Construction Standards – Process and Instrumentation – Symbols
WL-P0001	1-0601L-G-P0001-001-00D	Process – Process and Instrumentation Diagram
WL-P0002	1-0601L-G-P0002-001-00D	Process – Dewatering Pump Station – Process and Instrumentation Diagram
WM-E0010		Electrical – Symbols - Legend
WM-E0011		Electrical – Symbols - Legend
CM-G001		Construction Site Layout

E2. SOILS INVESTIGATION REPORT

E2.1 Further to GC:3.1, a copy of the geotechnical information is available on the Winnipeg Water Treatment Program – Project Site Information page at The City of Winnipeg, Corporate Finance, Materials Management Branch internet site at http://www.winnipeg.ca/matmgt/projects

E2.2 Test Hole Logs

E2.2.1 Geotechnical information has been compiled from various sources to summarize subsurface conditions within the work area. Test_Hole_Logs-Set1.pdf and Test_Hole_Logs-Set2.pdf at the aforementioned internet site.

(a) By UMA Engineering

(i) TH's 04-01 to 04-10, 04-12 to 04-24, 04-31, and 04-33 to 04-50 (2004)

(ii) TH's 1 to 3 (1996)

(b) By Others

(i) TH A13 by KGS Group (1991)

(ii) TH's 3 to 6 by RM Hardy & Associates (1977)

(iii) TH 1 and 2 by Dyregrov Consultants (1993)

E2.2.2 A geotechnical report has been prepared by UMA Engineering Ltd for the area of the dewatering cells. This is included for information in Test_Hole_Logs-Set2.pdf at the aforementioned internet site. Figure-01 included in Test_Hole_Logs-Set2.pdf illustrates the test hole locations in relation to the work area.

E2.2.3 Within the City of Winnipeg Water Treatment Plant Preliminary Design Report – Section 14 Geotechnical Investigation (2005), UMA Test Hole information is considered accurate at the locations drilled and at the time of the investigations. The inclusion of test hole data recorded by others does not represent any guarantees to the accuracy of this data.

E2.2.4 Test hole information is provided to assist in the Bidder's evaluation of subsurface conditions and the Bidder shall solely be responsible for any interpretation that they make from this information. Variations in soil conditions may exist between test holes and fluctuations in groundwater levels can be expected seasonally and may occur as a result of construction activities or operation of the Floodway.

E2.3 Reports

E2.3.1 Additional reports and geotechnical information listed as follows are available for viewing at the offices of Earth Tech Canada Inc., 850 Pembina Highway, Winnipeg, Manitoba.

(a) The City of Winnipeg Water Treatment Plant Preliminary Design Report – Section 14 Geotechnical Investigation (2005)

(b) Water Impounding Reservoir - Cell #2 and Booster Pumping Station Deacon Manitoba by RM Hardy & Associates Ltd. (1977)

(c) Proposed Venturi Chambers Deacon Reservoir by Dyregrov Consultants (1993)

(d) Deacon Reservoir Expansion Proposed Groundwater Monitoring Program by KGS Group (1993)

(e) Shoal Lake Aqueduct Program 5 – Deacon Drainage Improvements by UMA Engineering Ltd. (1996)

(f) Pile Driving records from Deacon Booster Pumping Station by RM Hardy and Associates (1979).

(g) Pile Driving records for the Clearwell construction Bid Opportunity 166-2005 by Earth Tech (Canada) Inc. (2005).

Information in these reports has been provided to assist in the Bidder's evaluation of subsurface conditions and the Bidder shall solely be responsible for any interpretation that they make from this information.

GENERAL REQUIREMENTS

E3. OFFICE AND SITE FACILITIES

E3.1 The Contractor shall supply office facilities for his own use and also for Concrete Quality Testing. The facilities shall be situated at the area designated on the drawings.

(a) Facilities for Concrete Quality Testing:

(i) The minimum facility floor area shall be 10 square metres

(ii) The facility shall have a door with lockable hardware

(iii) The facility shall have heating and cooling provisions to maintain a temperature between 15C and 25C

(iv) The facility shall be set up so that it is vibration free

(v) The facility shall be accessible seven (7) days a week for test sample pickup

E3.2 With reference to drawing CM-G001, the City will provide to the Contractor without cost:

(a) Granular pad for office location

(b) A 100A two pole breaker in Distribution A to serve office lighting, receptacles and convenience power (electric space heating equipment is not allowed)

(c) Communications connections for one telephone and internet (high speed equivalent). The Contractor shall supply and install the telephone service from the City's existing telephone service pedestal that is located in the contractor's office area.

(d) Onsite washroom and toilet facilities with non-potable water supply, and

(e) Power for construction purposes as required shall be provided by the Contractor.

E3.3 The Contractor may arrange for additional facilities with the approval of the Contract Administrator and at the Contractor's cost.

E4. SANITATION FACILITY

E4.1 A portable toilet supplied and maintained by the Contractor may be located near the dewatering cell area at a location approved by the Contract Administrator.

E4.2 The provision of a portable toilet, cleaning and regular maintenance shall be considered a subsidiary obligation of the Contractor. No payment shall be made for this item as it will be considered incidental to the Work.

E5. WASTE CONTAINER

E5.1 A waste container to dispose of garbage produced from the site shall be provided by the Contractor. It shall be located in a safe, convenient location, and be emptied as necessary by the Contractor. The provision, maintenance and removal of a waste container shall be considered a subsidiary obligation of the Contractor.

E6. SITE ROADS AND WORK SITE ACCESS

E6.1 The Contractor shall have access to the Site on Business Days between 07:00 and 18:00 unless otherwise approved by the Contract Administrator.

E6.2 Access to the work site is restricted and cooperation with other contractors on site is necessary in the best interest of all parties.

E6.3 The Site is located on Provincial Road 207, 3.2 km north of Highway 1 in Dugald, Manitoba.

E6.3.1 The Site address is PR 207, Lot 57082, Dugald, Manitoba.

E6.3.2 Provincial Road 207 is a Class B1 road and is subject to load restrictions which will affect the maximum weight of individual deliveries. However, The City of Winnipeg and Manitoba Transportation and Government Services (TGS) have reached the following agreement to facilitate construction of the Winnipeg Water Treatment Program:

(a) The approximately 3.2 km of PR 207 between the entrance to the Site and Highway 1 will be designated as an TAC Route for construction of the Winnipeg Water Treatment Program effective January 1, 2006 until TGS imposes Spring Restrictions.

(b) During the TGS imposed Spring Restriction period, normal (non Spring Restriction) Class B1 highway loadings will be allowed on PR 207 between the entrance to the Site and Highway 1. The Spring Restriction period is normally in place from March 23 to May 26, but it is subject to change due to weather conditions as assessed by TGS. Upon removal of the Spring Restriction, normal Class B1 will continue to be allowed.

(c) The portion of PR 207 between the entrance to the Site and Highway 1 will be upgraded during 2006 to a TAC Route. PR 207 will remain open during the upgrading process but users will be subjected to intermittent delays due to road construction.

(d) TGS permits will be required for each construction vehicle in excess of Class BI highway loading from January 1, 2006 until the upgrade of PR 207 has been completed:

(i) The Contract Administrator will provide permit forms to the Contractor.

(ii) The Contractor shall complete a permit form for each company retained to transport materials to the Site and shall return them to the Contract Administrator who will submit the permit forms to TGS for processing.

(iii) The Contract Administrator will return the completed permit forms to the Contractor and the Contractor shall ensure that each vehicle carries a photocopy of the permit.

(iv) The permit fee will be paid directly to TGS by the City of Winnipeg. The Contractor will not be charged for the permit fees.

(v) The permit will be good for 1 year from issue.

(vi) The Contract Administrator will establish a process to record the date, company name and commodity of each vehicle entering the Site.

(vii) TGS will make random permit checks of vehicles using PR 207

E7. SITE PREPARATION, DEWATERING, MOBILIZATION AND DEMOBILIZATION

E7.1 Description

E7.1.1 This specification covers site preparation including mobilization, equipment and fuel compounds and storage areas, site drainage, demobilization, final site clean up, and other Contractor related tasks required as a portion of the works for this Contract.

E7.1.2 The work to be done by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, materials and all things necessary for and incidental to the satisfactory performance and completion of all work as hereinafter specified.

E7.2 Site Drainage and dewatering

E7.2.1 Provision of adequate site drainage during the entire construction phase shall be the Contractor's responsibility. The Contractor shall maintain site grading as necessary to provide for proper drainage away from the excavated areas. This water is to be re-directed into ditches outside of the site. Silt fences shall be properly erected and keyed into the primary ditches to prevent eroded materials from leaving the site. No extra payment or time extension will be granted as a result of difficulties associated with site access resulting from poor site drainage during any part of the construction phase.

E7.2.2 The Contractor shall be responsible for keeping the excavated areas dewatered at all times. The Contractor shall prepare and submit a plan to dewater the excavations at the pre-construction meeting. The plan will be reviewed and approved by the Contract Administrator prior to commencement of a construction. If at any time the Contract Administrator deems the dewater efforts to be insufficient, the Contract Administrator may order the Contractor to modify and/or increase efforts at the sole discretion of the Contract Administrator with no additional time or compensation. The Contractor shall maintain dewatering until final completion of the contract.

E7.3 Final Site Cleanup

E7.3.1 The Contractor shall clean up and remove work-related surplus materials, tools, equipment, waste, and debris at the completion of the contract.

E7.4 Method of Measurement and Basis of Payment

(a) No measurement will be made for site preparation, mobilization, site drainage, dewatering and demobilization. No payment shall be made for site preparation, mobilization, site drainage, dewatering and demobilization as this item will be considered incidental to the Work.

E8. PROTECTION OF INSTRUMENTATION

E8.1 The Contractor is advised that abandoned and operational instrumentation (both existing and to be installed at the commencement of construction) is located within the work area. Operational instrumentation shall be protected during construction. No direct payment will be made for instrumentation protection, as this work will be considered incidental to the contract.

E8.1.1 Operational instrumentation damaged by the Contractor shall be repaired or replaced to the satisfaction of the Contract Administrator by the Contractor at his expense.

E9. CONDITION, PROTECTION OF, AND ACCESS TO THE AQUEDUCT

E9.1 Condition of the Aqueduct

E9.1.1 The Aqueduct is constructed of reinforced concrete and in some areas, contains numerous cracks. The Aqueduct, therefore, shall be considered as a fragile structure. All work procedures conducted by the Contractor on and/or near the Aqueduct shall be well planned and executed to ensure that the Aqueduct is not subjected to construction related loads, including excessive vibrations and concentrated or asymmetrical lateral loads.

E9.2 Protection of the Aqueduct

E9.2.1 Contractors working in the vicinity of the aqueduct shall ensure that:

(a) Equipment shall only be permitted to cross the Aqueduct at designated bridge crossing locations and shall come to a complete stop before crossing.

(b) Granular material, construction material, soil or other material shall not be stockpiled on the Aqueduct or within 10 metres of the Aqueduct centreline.

(c) Construction practices shall not subject the Aqueduct arch to asymmetrical loading at any time.

(d) Construction practices or procedures at or near the Aqueduct shall not impart excessive vibration loads on the Aqueduct and/or cause settlement of the subgrade below the Aqueduct.

E9.2.2 It is the Contractors' responsibility to ensure that all work crew members understand, observe, and work to the requirements of Specifications.

E9.3 Equipment Restrictions

E9.3.1 Equipment must cross the Aqueduct in a responsible and careful manner (i.e. slowly).

E10. ENVIRONMENTAL PROTECTION

E10.1 The Contractor shall be aware that the Aqueduct is for potable water supply and no contamination by fuel, chemicals, etc. shall be permitted at any time. Fuels or chemicals shall not be stored within 30 metres of the Aqueduct.

E10.2 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.

E10.3 The Contractor is advised that at least the following Acts, Regulations, and By-laws apply to the Work:

E10.3.1 Federal

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

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

E10.3.2 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) Current applicable associated regulations.

(i) The Fisheries Act

(j) The Migratory Birds Act

(k) The Historic Resources Act

(l) Drinking Water Safety Act

E10.3.3 The Contractor is advised that the following environmental protection measures apply to the Work.

E10.3.4 Materials Handling and Storage

(a) Construction materials shall not be stored within ten (10) metres of the Aqueduct centerline without the approval of the Contract Administrator.

E10.3.5 Fuel Handling and Storage

(a) The Contractor shall abide by the requirements of Manitoba Conservation storage and handling of Petroleum Products and Allied Products Regulations for handling and storage of fuel products.

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

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

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

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

(f) When servicing requires the drainage or pumping of fuels, lubricating oils or other fluids from equipment, a groundsheet of suitable material (such as HDPE) and size shall be spread on the ground to catch the fluid in the event of a leak or spill. No repairs within 30 m of aqueduct or watercourse will be permitted.

(g) Refuelling of mobile equipment and vehicles shall take place at least 30 m from a watercourse.

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

(i) A sufficient supply of materials, such as absorbent material and plastic oil booms, to clean up minor spills shall be stored nearby on-site. The Contractor shall ensure that additional material can be made available on short notice. All refuelling vehicles shall be equipped with a spill response kit.

E10.3.6 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 within 30 m of watercourses; contaminated water from onshore cleaning operations shall not be permitted to enter watercourses.

E10.3.7 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 and meet training requirements for these Regulations.

E10.3.8 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 Conservation, 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. (Should include reference to a site-specific Emergency Response Plan and Environmental Protection Plan.)

(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 Conservation 24-hour Spill Response Line (204) 945-4888, RCMP (Oakbank Detachment) (911), City of Winnipeg Fire Department (911), Springfield Ambulance (911), company backup, contact Contract Administrator.

(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
- dyke spill material with dry, inert sorbent material or dry clay soil or sand
- prevent spill material from entering waterways and utilities by dyking
- prevent spill material from entering Aqueduct manholes and other openings by covering with rubber spill mats or dyking

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

E10.4 The emergency response coordinator shall ensure that all environmental accidents involving contaminants shall be documented and reported to the Manitoba Conservation according to The Dangerous Goods Handling and Transportation Act Environmental Accident Report Regulation 439/87.

E11. RECORD DRAWINGS

E11.1 The Contractor shall keep one (1) complete set of white prints at their Site office, including all Addenda, Change Orders, Field Instructions, and other revisions for the purposes of Record Drawings. As the Work proceeds, the Contractor shall clearly record in red pencil all as-built conditions which deviate from the original Contract documents.

E11.2 The Record Drawings shall be available for review by the Contract Administrator upon request at any time during the performance of the Work.

E11.3 Prior to achieving Total Performance, the Contractor shall submit the Record Drawings prepared pursuant to E11.1 to the Contract Administrator for his review and use. If, in the opinion of the Contract Administrator, the Record Drawings are incomplete or inaccurate, the Record Drawings will be returned to the Contractor and the Contractor shall revise and resubmit the Record Drawings at his cost.

E11.4 Total Performance cannot be achieved without the submission of Record Drawings as specified in E11.1 and that are acceptable to the Contract Administrator.

SUBMITTALS

1. SHOP DRAWINGS

1.1 General

.1 Arrange for the preparation of clearly identified Shop Drawings as specified or as the Contract Administrator may reasonably request. Shop Drawings are to clearly indicate materials, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes, and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop Drawings are to indicate their relationship to design Drawings and Specifications. Notify the Contract Administrator of any deviations in Shop Drawings from the requirements of the Contract Documents to allow the Contract Administrator to assess the deviations.

.2 Where all or part of the Shop Drawings are to be prepared under the stamp and seal of a Professional Engineer registered in the Province of Manitoba, the Contract Administrator will limit that review to an assessment of the completeness of the part of the submission so stamped and sealed.

1.2 Electrical and Controls Installation Information

.1 Key information will be taken from Shop Drawings to prepare electrical and instrumentation Drawings and/or layout Drawings, control schematics, and interconnection wiring diagrams.

1.3 Submission Requirements

.1 Coordinate each submission with requirements of the Work and Contract Documents. Individual submissions will not be reviewed until all related information is available.

.2 Accompany submissions with a transmittal letter, in duplicate, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each Shop Drawing product.

.5 Equipment tag number.

.6 Other pertinent data.

.3 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Contractor.

.2 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative, certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 As required in the Specifications, the seal and signature of a Professional Engineer registered in the Province of Manitoba.

.4 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout showing dimensions including identified field dimensions and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Method of control of equipment and its communication with the City's SCADA system.

1.4 Drawings

.1 Original Drawings or modified standard Drawings provided by the Contractor to illustrate details of portions of Work which are specific to project requirements.

.2 Maximum sheet size: 850 x 1050 mm.

.3 Submit six (6) prints and one (1) reproducible copy of Shop Drawings. The Contract Administrator will return the reproducible copy with comments transcribed.

.4 Cross-reference Shop Drawing information to applicable portions of the Contract Documents.

.5 Include reviewed Shop Drawings in all O&M Manuals.

1.5 Product Data

.1 Manufacturer's catalogue sheets, brochures, literature, performance charts, and diagrams used to illustrate standard manufactured products.

.2 Submit six (6) copies of product data.

.3 Sheet size: 215 x 280 mm.

1.6 Electronic Submittals

.1 Provide electronic copies of all submittals within sixty (60) business days of stamped "Reviewed" or "Reviewed as Modified".

1.7 Shop Drawing Review

.1 Shop Drawing review by the Contract Administrator is solely to ascertain conformance with the general design concept. Responsibility for the approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.

.2 Review by the Contract Administrator shall not relieve the Contractor of his responsibility for errors or omissions in Shop Drawings or for proper completion of the Work in accordance with the Contract Documents.

.3 Shop Drawings will be returned to the Contractor with one of the following notations:

.1 When stamped "REVIEWED", distribute additional copies as required for execution of the Work.

.2 When stamped "REVIEWED AS MODIFIED", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".

.3 When stamped "REVISE AND RE-SUBMIT", make the necessary revisions, as indicated, consistent with the Contract Documents and submit again for review.

.4 When stamped "NOT REVIEWED", submit other drawings, brochures, etc. for review consistent with the Contract Documents.

.5 Only Shop Drawings bearing "REVIEWED" or "REVIEWED AS MODIFIED" shall be used on the Work unless otherwise authorized by the Contract Administrator.

.4 After submittals are stamped "REVIEWED" or "REVIEWED AS MODIFIED", no further revisions are permitted unless re-submitted to the Contract Administrator for further review.

.5 Any adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of Work.

.6 Make changes in Shop Drawings which the Contract Administrator may require consistent with Contract Documents. When re-submitting, notify the Contract Administrator in writing of any revisions other than those requested by the Contract Administrator.

.7 Shop Drawings indicating design requirements not included in the Contract Documents require the seal of a Professional Engineer, registered in the Province of Manitoba. If requested, submit engineering calculations for review, sealed by a Professional Engineer.

1.8 Operation and Maintenance Manuals

.1 Refer to Section 01730 – Operation and Maintenance Manuals.

END OF SECTION

QUALITY CONTROL

1. CODES AND STANDARDS

.1 In the case of a conflict or discrepancy between the Contract Documents and the governing standards, the more stringent requirements shall apply.

.2 Unless the edition number and date are specified, the reference to the Manufacturer's and published codes, standards, and specifications are to the latest edition published by the issuing authority, current at the Submission Deadline.

.3 Reference standards and Specifications are quoted in this Specification to establish minimum standards. Work in quality exceeding these minimum standards conforms to the Contract.

.4 Where reference is made to a Manufacturer's direction, instruction, or Specification it is deemed to include full information on storing, handling, preparing, mixing, installing, erecting, applying, or other matters concerning the products pertinent to their use and their relationship to the products with which they are incorporated.

.5 Confine apparatus, the storage of products and the operations of workers to limits indicated by laws, ordinances, permits, and by directions of the Contract Administrator. Do not unreasonably encumber the premises with products.

.6 Where reference is made to regulatory authorities, it includes all authorities who have, within their constituted powers, the right to enforce the laws of the Place of Work.

2. TESTING AND QUALITY CONTROL

.1 Provide to the Contract Administrator, when requested and consistent with progress of the Work, test results and designs specified in the Contract Documents or required by by-laws, statutes, and regulations relating to the Work and the preservation of public health, including the following:

.1 Inspection and testing performed exclusively for the Contractor's convenience.

.2 Testing, adjusting, and balancing of process equipment and systems, conveying equipment and systems, mechanical, electrical, and I&C equipment and systems.

.3 Mill tests and certificates of compliance.

.4 Tests for reinforcing steel unidentified by mill test reports.

.2 The Contract Administrator will select and the City will pay for the services of a testing agency or laboratory for material quality control tests that are required but not specified. Tests required by by-laws, statutes, and regulations applicable to the Work are the responsibility of the Contractor.

.3 Compliance and performance testing of equipment, pipe, conduit, wiring, and other items covered in other Divisions of this Specification are the responsibility of the Contractor,

unless specified otherwise. The City may replicate any series of tests to provide random checks on the compliance and performance tests at the City's cost.

.4 Remove and replace products indicated in inspection and test reports as failing to comply with the Contract Documents.

.5 Correct improper installation procedures reported in the inspection and test reports.

.6 Pay the costs for the re-inspection and re-testing of replaced Work.

.7 It is not the responsibility of the inspection and testing agents to supervise, instruct in current methods or accept or reject a part of the Work, but only to inspect, test, and to report conditions.

.8 Notify the Contract Administrator and the appropriate inspection and testing agent not less than forty eight (48) hours prior to the commencement of the part of the Work to be inspected and tested.

.9 Ensure the presence of the authorized inspection and testing agent at the commencement of the part of the Work specified to be inspected or tested.

.10 Ensure the inspection and testing reports are issued within forty eight (48) hours, and that the Contract Administrator is notified forthwith if the report indicates improper conditions or procedures.

.11 Cooperate with and provide facilities for the inspection and testing agents to perform their duties.

.12 Provide proper facilities for the storage of specimens or samples at correct temperature, free from vibration or damage in accordance with the instruction of the inspection and testing agent and the governing standard.

.13 Submit four (4) copies of each laboratory test report, unless specified otherwise, each copy signed by a responsible officer of the inspection and testing laboratory. Each report is to include:

.1 Date of issue.

.2 Contract name and number.

.3 Name and address of inspection and testing company.

.4 Name and signature of inspector or tester.

.5 Date of inspection or test.

.6 Identification of the product and Specification Section covering inspected or tested Work.

.7 Location of the inspection or the location from which the tested product was derived.

.8 Type of the inspection or test.

.9 The remarks and observations on compliance with the Contract Documents.

.14 Correct defective Work within the Contract Time; the performing of such Work is not a cause for an extension of the Contract Time.

END OF SECTION

EQUIPMENT INSTALLATION

1. INTENT

.1 This Section describes general requirements for all equipment supplied under the Contract relating to the supervision of installation, testing, operation, and performance verification. The Contractor shall be responsible for the supply, installation work, testing, operation, and performance verification of equipment in this Contract.

2. EXPERTISE AND RESPONSIBILITY

.1 The Contract Administrator recognizes the expertise of the Manufacturer.

.2 Should the Contract Administrator issue an Addendum, Field Order, Change Order, or Instruction to change the Work which would, in the opinion of the Contractor, compromise the success or safety of the Work, then it shall be incumbent on the Contractor to notify in writing the Contract Administrator to this effect within two (2) days.

3. EQUIPMENT DELIVERY

.1 The Contractor shall be responsible for equipment delivery to the Site.

.2 The Contractor shall be responsible for all equipment at the Site.

.3 The Contractor shall ensure that he is fully informed of precautions to be taken in the unloading of equipment and its subsequent storage.

.4 If equipment off-site storage is required, then the second move of the equipment to the Site will be at the Contractor’s cost.

4. INSTALLATION ASSISTANCE

.1 Before commencing installation of equipment, the Contractor shall arrange for the attendance of the Manufacturer's Representative to provide instructions in the methods, techniques, precautions, and any other information relevant to the successful installation of the equipment.

.2 The Contractor shall inform the Contract Administrator, in writing, of the attendance at the Site of any Manufacturer's Representative for installation training at least fourteen (14) days prior to arrival.

.3 When the Manufacturer's Representative is satisfied that the Contractor is aware of all installation requirements, he shall so certify by completing Form 101 – Certificate of Readiness to Install attached to this Specification.

.4 The completed form shall be delivered to the Contract Administrator prior to departure of the Manufacturer's Representative from the Site.

.5 Installation of the equipment shall not commence until Contract Administrator has advised that he has received the completed Form 101.

.6 Separate copies of Form 101 shall be used for different equipment.

5. INSTALLATION

.1 If necessary, or if so directed by the Contract Administrator during the course of installation, the Contractor shall contact the Manufacturer to receive clarification of installation procedures, direction, or any other additional information necessary to continue or complete the installation in an appropriate manner.

.2 If it is found necessary, or if so directed by the Contract Administrator, the Contractor shall arrange for the Manufacturer's Representative to visit the site to provide assistance during installation, all at the Contractor’s cost.

.3 Prior to completing installation, the Contractor shall inform the Manufacturer and arrange for the attendance at the Site of the Manufacturer's Representative to verify successful installation.

.4 The Manufacturer’s Representative shall conduct a detailed inspection of the installation including alignment, electrical connections, belt tensions, rotation direction, running clearances, lubrication, workmanship and all other items as required to ensure successful operation of the equipment.

.5 The Manufacturer’s Representative shall identify any outstanding deficiencies in the installation.

.6 The deficiencies shall be rectified by the Contractor and the Manufacturer’s Representative will be required to re-inspect the installation, at no cost to the City.

.7 When the Manufacturer’s Representative accepts the installation, he shall certify the installation by completing Form 102 – Certificate of Satisfactory Installation, attached to this Specification.

.8 Deliver the completed Form 102 to the Contract Administrator prior to departure of the Manufacturer's Representative from the Site.

.9 Tag the equipment with a 100 x 200 mm card stating “EQUIPMENT CHECKED. DO NOT RUN” stenciled in large black letters. Sign and date each card.

.10 Provide separate copies of Form 102 for different equipment.

6. OPERATION AND PERFORMANCE VERIFICATION

.1 Equipment will be subjected to a demonstration, running test, and performance tests after the installation has been verified and any identified deficiencies have been remedied.

.2 Inform the Contract Administrator at least fourteen (14) days in advance of conducting the tests and arrange for the attendance of the Manufacturer's Representative. The tests may be concurrent with the inspection of satisfactory installation if mutually agreed by the Contractor and the Contract Administrator.

.3 The Manufacturer's Representative shall conduct all necessary checks to equipment and if necessary, advise the Contractor of any further checking, flushing, cleaning, or other work needed prior to confirming the equipment is ready to run.

.4 The Contractor shall then operate the equipment for at least one (1) hour to demonstrate to himself the operation of the equipment and any required ancillary services. Any remedial measures required to ensure satisfactory operation shall be promptly undertaken.

.5 Demonstration:

.1 The Contractor shall then notify the Contract Administrator of his readiness to demonstrate the operation of the equipment. The Contract Administrator shall attend, as expeditiously as possible.

.2 With the assistance of the Manufacturer's Representative, the Contractor shall demonstrate that the equipment is properly installed. Alignment, piping connections, electrical connections, etc. will be checked and if appropriate, code certifications provided.

.3 The equipment shall then be run for one (1) hour. Local controls shall be satisfactorily verified by cycling the equipment through several start-stop operations, modulating its output, or some combination. Operating parameters such as temperature, pressure, voltage, vibration, etc., will be checked to ensure that they are within the specified or Manufacturer's recommended limits, whichever is more stringent.

.4 On satisfactory completion of the one (1) hour demonstration, the equipment will be stopped and critical parameters, such as alignment, will be rechecked.

.6 Running Test:

.1 The equipment will be restarted and run continuously for three (3) days. During this period, as practicable, conditions will be simulated which represent maximum or most severe, average, and minimum or least severe conditions. These conditions will be mutually agreed by the Manufacturer's Representative, the Contractor, and Contract Administrator on the basis of the information contained in the technical specifications, as well as the methods utilized to create the simulated conditions and the time periods allotted to each.

.7 Performance Tests:

.1 Performance tests shall be conducted either concurrent with or subsequent to the running test, as practicable and agreed between the Contract Administrator, the Manufacturer's Representative, and the Contractor.

.2 Performance tests shall be as dictated in the technical specifications for each item of equipment or as reasonably required by the Contract Administrator to prove adherence to the requirements listed in the Specification.

.3 The Contractor shall submit the results of the performance tests to the Contract Administrator, documented and summarized in a format acceptable to the Contract Administrator. The Contract Administrator reserves the right to request additional testing. No equipment shall be accepted and handed over to the City prior to the satisfactory completion of the performance test(s) and receipt of the test reports.

.8 All water, chemicals, temporary power, heating, or any other ancillary services required to complete the initial demonstration, running test and performance tests are the responsibility of the City.

.9 Should the initial demonstration, running test or performance tests reveal any defects, then those defects shall be promptly rectified and the demonstration, running tests, and/or performance tests shall be repeated to the satisfaction of the Contract Administrator. Additional costs incurred by the Contractor, the Contract Administrator, or the City, due to repeat demonstration, running tests, and/or performance tests shall be the responsibility of the Contractor.

.10 On successful completion of the demonstration, running test, and performance tests, Form 103 – Certificate of Equipment Satisfactory Performance attached to this specification will be signed by the Manufacturer's Representative, the Contractor, and the Contract Administrator.

.11 The Contractor shall affix to the tested equipment a 100 mm x 200 mm card reading "OPERABLE CONDITION - DO NOT OPERATE WITHOUT CONTRACTOR'S PERMISSION." stenciled on in large black letters.

EQUIPMENT INSTALLATION

CERTIFICATE OF EQUIPMENT DELIVERY
FORM 100

We certify that the equipment listed below has been received and delivered into the care of the Prime Contractor. The equipment has been found to be in satisfactory condition. No defects in the equipment were found.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____
(Authorized Signing Representative of the Contractor) Date

_____ _____
(Authorized Signing Representative of the Manufacturer) Date

_____ _____
(Authorized Signing Representative of the Contract Administrator) Date

EQUIPMENT INSTALLATION

CERTIFICATE OF READINESS TO INSTALL
FORM 101

I have familiarized the installer of the specific installation requirements related to the equipment listed below and am satisfied that he understands the required procedures.

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____
(Authorized Signing Representative of the Manufacturer) Date

I certify that I have received satisfactory installation instructions from the equipment Manufacturer/ Supplier.

_____ _____
(Authorized Signing Representative of the Contractor) Date

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY INSTALLATION
FORM 102

I have completed my check and inspection of the installation listed below and confirm that it is satisfactory and that defects have been remedied to my satisfaction except any as noted below:

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

OUTSTANDING DEFECTS: _____

_____ _____
(Authorized Signing Representative of the Manufacturer) Date

_____ _____
(Authorized Signing Representative of the Contractor) Date

_____ _____
(Authorized Signing Representative of the Contract Administrator) Date

EQUIPMENT INSTALLATION

CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE FORM 103

We certify that the equipment listed below has been continuously operated for at least seven (7) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: _____

ITEM OF EQUIPMENT: _____

_____

TAG NO: _____

REFERENCE SPECIFICATION: _____

_____ _____
(Authorized Signing Representative of the Manufacturer) Date

_____ _____
(Authorized Signing Representative of the Contractor) Date

_____ _____
(Authorized Signing Representative of the Contract Administrator) Date

1. Acknowledgement of Receipt of O&M Manuals.

_____ _____
(Authorized Signing Representative of the City) Date

END OF SECTION

OPERATION AND MAINTENANCE MANUALS

1. DESCRIPTION

.1 This Section supplements the requirements for the provision of O&M Manuals as described in Section 01300 – Submittals.

.2 Furnish complete operations manuals and maintenance information as specified in this Section for installation, check-out, operation, maintenance, and lubrication requirements for each unit of mechanical, electrical, and instrumentation equipment or system and each instrument.

.3 Customize the operations manuals and maintenance information to describe the equipment actually furnished. Do not include extraneous data for models, options, or sizes not furnished (cross out or remove if required). When more than one model or size of equipment type is furnished, show the information pertaining to each model, option, or size.

.4 Assemble, coordinate, bind, and index required data into an O&M Manual.

.5 Three (3) draft copies of the manuals shall be submitted a minimum of sixty (60) days prior to Substantial Performance of the Work for review and comments. A maximum of eight (8) weeks after review, twelve (12) copies of the final manuals shall be supplied.

.6 In addition to the twelve (12) hard copies, submit an electronic version of the O&M Manual.

.7 Materials: Label each Section with tabs protected with celluloid covers, fastened to hard paper dividing sheets.

.8 Type lists and notes.

.9 Drawings, diagrams, and Manufacturer's literature must be legible. Drawings larger than 280 x 430 mm must be folded and placed inside plastic pockets.

2. OPERATION AND MAINTENANCE MANUAL CONTENTS AND ORGANIZATION

.1 Provide the Manufacturer’s standard O&M manuals for the equipment or instruments supplied. If the Manufacturer's standard manuals do not contain all the required information, provide the missing information in supplementary documents and Drawings inserted behind appropriate tabs in the manual binder.

.2 When more than one piece of identical equipment or instruments is supplied, provide only one (1) set of operations manuals.

.3 One (1) set of operations manuals may be provided when more than one piece of similar equipment or instruments are supplied, such as different sizes of the same model, and all similar pieces are covered in the same standard Manufacturer's O&M manual.

.4 When similar equipment or instruments are provided by the same Manufacturer, but are not covered in the same standard Manufacturer's O&M manual, their specific manuals may be

bound in the same 3-ring binder. Separate specific manuals with tab dividers labelled with the appropriate equipment numbers.

.5 Provide a cover sheet, bound as the first page of each manual, with the following information:

.1 Contract name and number.

.2 Equipment number or, if more than one piece of equipment is provided, equipment numbers for equipment or instruments covered by the manual. Include functional description of equipment after each number.

.6 Provide a table of contents listing the contents of the manual and identifying where specific information can be located.

.7 Insert the specific information described below in the O&M manuals in a format similar to that listed:

.1 Tab 1 – General Information

.1 Functional title of the system, equipment, material, or instrument.

.2 Relevant Specification Section number and Drawing reference.

.3 Address and telephone number of the Manufacturer and the nearest Manufacturer's Representative.

.2 Tab 2 - Equipment Data

.1 Insert Specification Section and completed equipment and instrumentation data sheets for equipment supplied. Attach all addenda, change orders, and change directives that refer to that specific item of equipment.

.3 Tab 3 – Operation Information

.1 Include the Manufacturer's recommended step-by-step procedures for starting and stopping under normal and emergency operation. Include all specified modes of operation including recommended operation after the assembly or equipment has been in long-term storage.

.2 Provide control diagrams with data and information to explain operation and control of systems and specific equipment. Identify normal operating setpoints and alarm conditions.

.3 Provide technical information on all alarms and monitoring devices provided with the equipment.

.4 Provide troubleshooting information. Clearly identify which problems to look for and how to solve them.

.4 Tab 4 - Technical Data

.1 Insert Manufacturer's technical specification and data sheets.

.2 Insert Manufacturer's certified performance and calibration curves for the equipment and instruments.

.5 Tab 5 - Maintenance Information

.1 Include the description and schedule for all Manufacturers' recommended routine preventative maintenance procedures including specific lubrication recommendations. Indicate whether procedure is to be done daily, weekly, monthly, quarterly, semi-annually, annually, or fill in hours of operation.

.6 Tab 6 - Maintenance Instructions

.1 Provide requirements to set up and check out each system for use. Include all required and recommended step-by-step inspections, lubrications, adjustments, alignments, balancing, and calibrations. Include protective device settings, warnings, and cautions to prevent equipment damage and to insure personnel safety.

.2 Provide Manufacturer's description of routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair.

.3 Provide Manufacturer's recommendations on procedures and instructions for correcting problems and making repairs.

.4 Provide step-by-step procedures to isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

.5 Provide step-by-step procedures and list special required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required.

.7 Tab 7 - Assembly Drawings

.1 Provide Drawings which completely document the equipment, assembly, subassembly, or material for which the instruction is written. Provide the following Drawings as applicable: fabrication details, wiring and connection diagrams, electrical and piping schematics, block or logic diagrams, Shop Drawings, installation Drawings, layout and dimension Drawings, and electrical component fabrication Drawings.

.2 Provide clear and legible illustrations, Drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

.8 Tab 8 - Bills of Materials

.1 Provide a clear, legible copy of the Bill of Materials that was shipped with the equipment. The Bill of Materials should list all equipment, instruments, components, accessories, tools, and other items that were shipped with the equipment.

.9 Tab 9 - Lubrication Data

.1 Provide a table showing recommended lubricants for specific temperature ranges and applications.

.2 Provide charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

.3 If the equipment or instrument is not lubricated, add a sheet under this Tab with the words "NOT APPLICABLE".

3. FIELD CHANGES

.1 Following the acceptable installation and operation of an equipment item, modify and supplement the item's instructions and procedures to reflect any field changes or information requiring field data.

4. COMMISSIONING DATA

.1 Provide in hard cover 3-ring binders for 215 x 280 mm paper labelled "Commissioning Data" one (1) copy of:

.1 All completed equipment testing and commissioning forms.

.2 All completed equipment checklists and performance reports, including noise and vibration analysis, instrumentation calibration data, and all other relevant information.

.3 All system performance reports.

5. WARRANTIES

.1 Provide in hard cover 3-ring binders for 215 x 280 mm paper labelled "Warranties" one (1) copy of:

.1 Manufacturers' standard Warrants and Guarantees. Include the name and telephone number of the contact person. Indicate the time frame of each Warrant or Guarantee on the list.

END OF SECTION

EXCAVATION AND BACKFILLING FOR STRUCTURES

1. GENERAL

1.1 Work Included

.1 Work under this Section includes, but is not necessarily limited to the following items:

.1 Excavation in the berm to required elevations for the structures.

.2 Backfill of the structures to required finish elevations.

.3 Disposal of surplus excavated material.

.4 Dewatering of excavations during construction.

1.2 Reference Standards

.1 Conform to requirements of the NBC and the Canadian Construction Safety Code.

.2 Comply with excavation and trenching regulations of Provincial authorities.

1.3 Samples

.1 All materials incorporated into the Work of this Specification shall be subject to review and testing by the Contract Administrator, including all operations from the selection and separation of the materials, through to final acceptance of the specified Work.

.2 The Contractor shall be wholly responsible for the control of all operations incidental to the Work, notwithstanding any review or acceptance that may have previously been given.

.3 The Contract Administrator reserves the right to reject any materials or works which are not in accordance with the requirements of this Specification.

.4 There shall be no charge for any materials taken by the Contract Administrator for testing purposes.

.5 All materials shall be reviewed and accepted by the Contract Administrator at least ten (10) days before any construction is undertaken.

.6 For granular materials, when requested by the Contract Administrator, submit a 25 kg sample for coarse, gravelly soil, or 75 kg sample for coarse, crushed stone and sand of each type, clearly labelled for type and source of the materials, for analysis by testing laboratory. Ship samples prepaid or deliver in tightly closed containers to testing laboratory designated by Contract Administrator.

.7 Costs for analysis will be paid by the City.

1.4 Compaction Testing

.1 Testing of compacted fill materials will be performed by an independent inspection and testing firm appointed and paid by the City. Testing will be performed so as to least encumber the performance of the Work.

.2 The City will pay for the first series of tests only, on the area being evaluated. Pay costs for additional testing, if required, due to improper performance of Work.

.3 Tests will be performed in accordance with ASTM D698 for Standard Proctor Density on representative samples to control compaction requirements. The Contract Administrator will decide the frequency and number of tests required.

.4 The field density of the compacted layers shall be verified by field density tests in accordance with ASTM D2922, using nuclear methods performed by the inspection and testing firm. The frequency and number of tests required will be decided by the Contract Administrator.

.5 Notify the Contract Administrator when Work of this Section or portions of Work are completed to own satisfaction. Do not proceed with additional portions of Work until test results have been verified and accepted.

.6 During Work tests, if tests indicate that compacted materials do not meet specified required materials, remove defective Work, replace and re-test at own expense as directed by the Contract Administrator.

.7 Ensure compacted fills are tested and accepted before proceeding with placement of surface materials.

1.5 Geotechnical Information

.1 Refer to Specification E2 – Soils Investigation Report for a list of test hole logs and reports available associated with the Site.

.2 The Contractor should be aware that the soil condition in the excavation may be soft.

2. PRODUCTS

2.1 General

.1 All materials to be subject to Contract Administrator's acceptance.

.2 Granular materials to be composed of sound, hard, uncoated particles, free from injurious quantities of clay, flaky particles, soft shale, friable materials, roots, vegetable matter, and frozen lumps.

.3 Grading of granular materials to show no marked fluctuations between opposite ends of extreme limits.

.1 Type 1: pit run granular backfill shall consist of a clean, well-graded, and free-draining pit run material with a maximum size of 75 mm, and less than 5% by weight finer than 0.075 mm.

.2 Type 2: crushed gravel graded within following limits:

Canadian Metric Sieve Size	Percent Passing	
	Crushed Granular	Crushed Limestone
25,000	100	-
20,000	80 - 100	100
5,000	40 - 70	40 – 70
2,500	25 - 55	25 – 60
315	13 - 30	8 – 25
80	5 - 15	6 – 17

At least 60% of material retained on 5 mm sieve to have at least one (1) freshly fractured face.

.4 Type 3: pit run sand for levelling with maximum stone size 40 mm.

.5 Type 4: common backfill shall conform to the requirements of Section 02661 – Excavation, Haulage, and Placement.

3. EXECUTION

3.1 General

.1 Familiarization

.1 Prior to all Work of this Section, become thoroughly familiar with the Site, the Site conditions, and all portions of the Work falling within this Section.

.2 Review and understand the geotechnical information.

.2 Protection

.1 Before starting Work, locate all utilities crossing the Work Site. Notify all agencies or companies having jurisdiction over the specific utilities and protect, relocate, remove, or discontinue service according to their requirements. Any damages shall be repaired at the Contractor's expense.

.2 Protect and restore pavements, boulevards, grassed areas, etc., that may be opened or damaged in the performance of the Work.

.3 During construction, maintain roadways in a clean and safe condition and, at the completion of the Contract, clean and restore all roads used to perform the Contract.

3.2 Finish Elevations and Lines

.1 For setting and establishing finish elevations and lines, secure the services of a registered surveyor or experienced instrumentman acceptable to the Contract Administrator.

.2 Carefully preserve all data and all monuments set by the registered surveyor. If displaced or lost, immediately replace to the acceptance of the Contract Administrator, at no additional cost to the City.

3.3 Excavation

.1 Perform excavation in strict compliance to Work Place Safety and Health and authorities have jurisdiction.

.2 The Contractor shall submit the proposed excavation plan two (2) weeks prior to commencement of construction to the Contract Administrator for review and acceptance.

.3 Excavate to noted limits and as required for the Work of this Contract. Stockpile material to be used for backfilling On-Site as directed by the Contract Administrator. Excess material is to be disposed of immediately as per Item 3.7, Disposal.

.4 When complete, request Contract Administrator to review excavations.

.5 Local pockets of material which, in the opinion of the Contract Administrator are unsuitable, shall be removed to such depths as required by the Contract Administrator.

.6 The completed excavation shall provide clean, level, solid, and water-free surfaces at the required elevations, ready to receive construction.

.7 Excavations are not to encroach on existing slopes and as indicated in the geotechnical information.

.8 Make good all damage occurring as a result of inadequate, unauthorized, or defective methods of protection.

.9 Areas used for temporary stockpiling shall be restored to existing condition or better.

3.4 Shoring and Bracing

.1 Provide all shoring and bracing required for the Work to prevent damage to existing structures, excavations, and injury to personnel.

.2 Comply with all applicable rules and regulations of governmental authorities.

.3 Erect shoring and bracing independent of utilities and structures.

.4 Prefabricated cages or shields may be used to supplement or replace conventional shoring, provided they comply with all applicable safety regulations.

.5 Assume full responsibility for any failure, collapse, or movement of existing structures, shoring and bracing, earth banks, trenches, and other excavations.

3.5 Dewatering

.1 The Contractor shall be responsible for the control of surface drainage in the excavation.

.2 The Contractor shall submit the proposed dewatering plan two (2) weeks prior to commencement of construction to the Contract Administrator for review and acceptance.

.3 Dewatering systems shall be designed to expeditiously remove water from the excavation. Maintain dewatering system for a time period determined by the Contract Administrator.

.4 The dewatering systems must protect the subgrade soils from excessive softening and saturation.

.5 All access roadways shall employ culverts as required for the Contractor's proposed excavation dewatering plan.

.6 All temporary ditching and water retention areas shall be lined with an impervious membrane to the satisfaction of the Contract Administrator.

.7 Discharge from pumps or other dewatering equipment shall be located and controlled such that loss, damage, nuisance, or injury to the Work does not result.

.8 Additional excavation made necessary by water in the excavation shall be at no additional cost to the City.

3.6 Backfilling, Fill, and Compaction

.1 Preparation

.1 Ensure areas to be backfilled are free from debris, snow, ice, and water; and that ground surfaces are not in a frozen condition.

.2 Backfilling and Filling

.1 Backfill and fill to grades, contours, levels, and elevations as directed by the Contract Administrator.

.2 Maintain optimum moisture content of materials to permit compaction to specified densities.

.3 Compact each soil layer to at least the specified minimum degree; repeat compaction process until plan grade is attained. Compaction densities indicated herein are based on ASTM D698 for Standard Proctor Density.

.4 Fill for Over-Excavation: backfill over-excavation with Type 4 common fill in accordance with Section 02661 – Excavation, Haulage, and Placement. at no additional cost to the City.

.5 Fill around Structures: backfill around structures with Type 4 common fill in accordance with Section 02661 – Excavation, Haulage, and Placement. Backfill placement around structures shall be done all around structure simultaneously with maximum differential depth of fill of 500 mm.

.6 Place local ramping to Decanter walkways with Type 2 fill compacted to 90% Standard Proctor Density.

3.7 Disposal

.1 Surplus material not required for backfill and fill purposes shall be disposed of On-Site to a location designated by the Contract Administrator at no extra cost to the City.

3.8 Clean-Up

.1 As excavation proceeds, keep roads, streets, and sidewalks clean of dirt and excavated material.

.2 Clean-up and wash down to remove all dirt and excavated materials caused by Work of this Section.

.3 Clean at the end of each working day as directed by the Contract Administrator.

END OF SECTION

DRAIN PIPES

1. GENERAL

1.1 Scope of Work

.1 The Work of this Section outlines the requirements for the construction of the drain pipes in the cell dike areas including the collection header and cleanouts.

1.2 References

.1 ASTM C14M, Specification for Concrete Sewer, Storm Drain and Culvert Pipe.

.2 ASTM C76M, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

.3 ASTM D3034, Specification for Type PSM PVC Sewer Pipe and fittings.

.4 ASTM F 679 Standard Specification for PVC Large Diameter Plastic Gravity Sewer Pipe and Fittings Based.

.5 AASHTO M34 Specifications for PVC Ribbed Drain Pipe and Fittings Based on Controlled Inside Diameter

.6 ASTM F 794 Standard Specification for PVC Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

1.3 Samples

.1 At least two (2) weeks prior to commencing Work, inform the Contract Administrator of proposed source of bedding materials and provide access for sampling or if requested provide representative samples to the Contract Administrator for review.

1.4 Material Certification

.1 At least two (2) weeks prior to commencing Work, submit Manufacturer's test data and certification that pipe materials meet requirements of this Section.

1.5 Record Drawings

.1 Provide data necessary to produce record Drawings, including details of pipe material, invert elevations at manholes and connections, location of tees, bends, clean-outs, manholes, catch basins, saddles, laterals and caps.

2. PRODUCTS

2.1 Plastic Pipe

.1 PVC Pipe and Fittings as per the following:

.1 PVC Pipe and Fittings 400 mm diameter and smaller: to ASTM D3034, CSA Standard B182.2. Use IPEX Ring –Tite PVC DR35 unless otherwise indicated or approved equal. Pipe: Manufactured from clean, virgin approved class 12454-B compound conforming to ASTM D1784.

.2 Provide water tight gasket connections and integral bell system.

.3 Pipe to be supplied in either 4 or 6 m nominal lengths

2.2 Knife Gate Valves and Valve Boxes

.1 Cast iron body, stainless steel 316 disc, EPDM seats and seals, stainless steel 316 shaft, rated for 150 pound pressure, RS bonnetless (provide bonnet with stainless steel 316 stem extension), wiper ring to be reinforced PTFE, pillars to be stainless steel 316, flanged valve ends (ANSI 150) matching the pipe ends.

.2 All non stainless steel metal components to be epoxy coated in accordance with Section 11901 – Factory Applied Maintenance and Corrosion Protection Coatings and Manufacturer's specifications.

.3 Valves shall be suitable for operation with an operating nut from top of a concrete structure. Provide suitable length extension spindle with wall supports, operating nut and key. Valve boxes shall be ASTM A 48 cast iron, bituminous coated, valve operating extension rod shall be of such length that when set on valve operating nut top of rod will be between 150 mm and 450 mm below cover.

.4 Acceptable Manufacturer's

.1 DeZurik Series L

.2 Red Valve Series G, D

2.3 Pipe Bedding Materials

.1 Bedding material to meet dike and liner material requirements. Refer to City of Winnipeg Standard Construction Specifications for unspecified components.

3. EXECUTION

3.1 Preparation

.1 Clean pipes and fittings of debris, dirt, mud, ice and snow before installation. Inspect materials for defects before installing. Remove defective materials from Site.

3.2 Trenching and Backfill

.1 Do trenching and backfill in accordance with the Drawings and in compliance with the liner and dike Construction Specifications unless specified otherwise.

.1 Trench line and depth require approval prior to placing bedding material and pipe. Ensure foundation is adequate to receive bedding and pipe. Replace unsuitable material if required.

.2 Do not allow contents of any liquid to flow into trench.

.3 Do not backfill trenches until pipe grade and alignment have been checked.

3.3 Bedding

.1 Bed pipes to details indicated on Drawings. Bedding to include prepared foundation, bedding under pipe, haunching and initial backfill to a height of 300 mm above the top of pipe.

.2 Place granular bedding materials to details indicated or directed. Place bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm. Compact full width of bed to at least 95% of Standard Proctor density.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.

.4 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.

.5 Fill excavation below bottom of specified bedding adjacent to manholes, pump station, or other structures with compacted bedding material or unless specified differently on the Drawings.

3.4 Installation

.1 Lay and join pipe in accordance with Manufacturer's recommendations.

.2 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags and high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe Manufacturer.

.6 Do not allow water to flow through pipes during construction except as may be approved by Contract Administrator.

.7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Position and join pipes by approved methods recommended by manufacturer. Do not use excavating equipment to force pipe sections together.

.9 When any stoppage of Work occurs, block pipes as directed to prevent "creep" during down time.

.10 When utilizing concrete piping, plug lifting holes with approved prefabricated plugs set in non-shrink grout.

.11 Install PVC pipe and fittings in accordance with CSA B181.12.

.12 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner without damaging pipe and to leave a smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes and catch basins. Use non-shrink grout when suitable gaskets are not available.

3.5 Gasket Joints

.1 Install gaskets in accordance with Manufacturer’s recommendations.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes carefully before joining.

.4 Maintain pipe joints free from mud, silt, gravel, and other foreign material.

.5 Avoid displacing gasket or gasket contaminated with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in Manufacturer’s recommendations.

.9 Maintain pipe joints a minimum of 1.5 m from the side of rigid structures unless otherwise directed or approved by the Contract Administrator.

3.6 Alignment

.1 Install drain pipe to the line and grade shown on the Drawings or as directed by the Contract Administrator.

.2 Ensure horizontal variance from line does not exceed ± 100 mm.

.3 Allowable vertical variance from specified grade to be not more than 25 mm above the specified grade and 50 mm below specified grade at any one location. Allowable depth of ponding in pipe due to combined variance above or below specified grade shall not exceed 50 mm.

.4 Correct alignment and grade that exceed allowable variances and allowable depth of ponding.

3.7 Cleaning

.1 Complete drain cleaning in accordance with City of Winnipeg Standard Construction Specification CW 2140.

3.8 Deflection Testing

.1 Drain manhole inspection to be in accordance with City of Winnipeg Standard Construction Specification CW 2145.

END OF SECTION

BORED CAST-IN-PLACE CONCRETE PILES

1. GENERAL

1.1 Work Included

.1 Excavate and grade for equipment support at pile locations.

.2 Machine drill pile shafts.

.3 Dewatering.

.4 Place concrete and reinforcement and prepare piles for capping.

.5 Remove all excavated materials and deposit on-site where directed by Contract Administrator.

1.2 Quality Assurance

.1 Construct piles in accordance with CAN/CSA-A23.1-00.

1.3 Qualifications

.1 If required by Contract Administrator, produce satisfactory proof of successful installation experience with this type of foundation, in similar conditions, and with piles of similar capacities.

1.4 Pile Design

.1 Cast-in-place reinforced concrete type piles for friction resistance.

.2 Loading to be in sound clay material with a friction capacity of 14.4 kPa.

1.5 Shop Drawings

.1 Submit detailed Shop Drawings for review in accordance with Section 01300 – Submittals.

.2 Clearly identify pile lengths, diameters, reinforcement, steel casings, drilling, and concrete placement techniques, sequence, and related scheduling.

1.6 Inspection and Testing

.1 Submit concrete mix design as per Section 03300 – Cast-In-Place Concrete.

.2 Inspection and testing of concrete will be conducted as per Section 03300 – Cast-In-Place Concrete.

.3 Provide free access to all portions of Work and cooperate with inspection and testing personnel.

.4 Inspection and testing firm engaged and paid by the City will inspect soil conditions prior to placement of concrete or reinforcement. Cooperate and schedule inspection visits.

1.7 Field Records

.1 Contractor shall cooperate with the Contract Administrator and shall allow access during the pile installation operations so that all the field measurements can be performed expeditiously.

2. PRODUCTS

2.1 Materials

.1 Provide materials for concrete as per Section 03300 – Cast-In-Place Concrete.

.2 Provide steel reinforcement as per Section 03200 – Concrete Reinforcement.

.3 Provide concrete mix statement as per Section 03300 – Cast-In-Place Concrete.

3. EXECUTION

3.1 Condition of Site

.1 Preparation of Site for piling will be done under Section 02223 – Excavation and Backfilling for Structures. Ensure that Site conditions at each pile location are adequate to support piling equipment, to properly install piles, and permit load testing when required.

.2 Keep drilled holes free of water at all times, until concrete is placed.

.3 Provide necessary equipment including pumps, piping, and temporary drains and trenches.

.4 Do not discharge drainage water into municipal sewers without municipal approval.

3.2 Drilling

.1 Drill for piles where and as indicated on Drawings in the sequence as per reviewed Shop Drawings.

.2 Ensure pile shafts are drilled vertically to depths indicated on Drawings. Piles are not to deviate from true vertical alignment more than 2% of pile length, nor more than 100 mm off centre from true location, with tops not more than 25 mm from cut-off elevations shown on Drawings.

.3 Install steel casings in excavations if required to prevent cave-ins and water entry.

3.3 Placing Piles

.1 Arrange for review by inspection and testing firm of bored holes. Provide lighting necessary for review of shaft. Immediately after acceptance, place reinforcing steel and concrete. Perform these operations on the same day, for each pile.

.2 Reinforce in accordance with Drawings. Place reinforcing and secure in position. Provide concrete cover in accordance with CAN/CSA-A23.1-00. Extend steel for connection to supported structure.

.3 Place concrete to prevent concrete from striking sides of shaft and to prevent any foreign material from falling into shaft. Vibrate concrete in top 3 m of pile. Place concrete continuously from bottom to top.

.4 Place concrete by means of a tremie should an inflow of water occur that cannot be removed by pumping. Place to a height sufficient to effect a seal. Notify Contract Administrator and submit placing procedures for review prior to carrying out this Work.

.5 Form pile tops at cut-off elevations.

.6 During cold weather, provide concrete protection in accordance with CAN/CSA-A23.1-00.

3.4 Defective Piles

.1 Contract Administrator may, at his discretion, reject any pile that is out of alignment, out of position, or otherwise fails to meet specified requirements.

.2 Replace rejected piles with new piles as directed by the Contract Administrator at no additional cost to City.

.3 Cut off rejected piles 1000 mm below design cut-off elevations.

END OF SECTION

SUPPLY AND PLACEMENT OF RIP RAP

1. GENERAL

1.1 References

.1 CSA Standard A23.2.2 – Test for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM Standard C-127, "Method of Test for Specific Gravity and Absorption of Coarse Aggregates".

1.2 Source Quality Control

.1 Advise the Contract Administrator of sources of material to be utilized fourteen (14) days in advance of starting work. Submit samples (>50 kg) of all materials to be incorporated into the works. The Contractor shall assume all costs incurred in obtaining and shipping samples.

.2 The Contract Administrator reserves the right to reject the use of a particular material where, in his opinion, the character of the material does not conform to the requirements of the works.

2. PRODUCTS

2.1 Rip Rap

.1 Rip rap shall consist of clean, free draining, sound dense, durable crushed rock; free of organics, roots, silt, sand, clay, snow, ice, or other deleterious material.

.1 Dense, sound, hard and durable fieldstone or quarried rock fragments. Quarried rock fragments shall have a specific gravity of at least 2.6 and a limit of 2% absorption.

.2 Rock shall be hard white durable limestone or dolomite with the following properties:

.1 Minimum bulk specific gravity of 2.6 (ASTM C127)

.2 Maximum Los Angeles abrasion loss of 35% (ASTM C131)

.3 Maximum soundness loss of 18% (ASTM C88)

.4 Maximum absorption of 2.5% (ASTM C127)

Gradation Requirements Rip Rap	
Canadian Metric Sieve Size	**% of Total Dry Weight Passing Each Sieve**
400,000	100
250 000	40 – 60
50 000	0 – 5

.2 All debris, vegetation cobbles and other non desired material shall be cleaned from the place where hauled rip rap material is to be stockpiled near construction site.

2.2 Geotextile

.1 Geotextile shall be non woven with the following physical properties:

Physical Property	Requirements	Test Method
Grab Tensile Strength	890 N - minimum	ASTM D-4632
Puncture Strength	575 N - minimum	ASTM D-4833
Trapezoid Tear	355 N - minimum	ASTM D-4533
Apparent Opening Size	0.15 mm - maximum	ASTM D-4751
Permittivity	1.4 sec-1 - minimum	ASTM D-4491
U.V. Resistance	70 % per 500 hours - minimum	ASTM D-4355
Mullen Burst	2,750 Kpa – minimum	ASTM D-3786
Grab Tensile Elongation	50%	ASTM D-4632
Flow Rate	54 L/sec/M^2	ASTM D-4491

.2 All physical properties are to be minimum average roll values based in accordance with ASTM 4759

3. EXECUTION

3.1 General

.1 Prior to commencement of rip rap works, eliminate uneven areas and depressions on the area to be rip rapped by fine grading to a uniform even surface. Fill depressions with suitable material and compact to provide a firm bed.

.2 Obtain the Contract Administrators approval on finish slope prior to proceeding with rip rap works

3.2 Geotextile Fabric Placement

.1 Place geotextile fabric on the embankment slopes in locations as indicated on the Drawings or as directed by the Contract Administrator.

.2 Geotextile fabric is to be placed on a uniform, even surface. Fill depressions in bedding with additional bedding material and compact to provide firm level bed.

.3 For rip rap on ditches or swales:

.1 Install geotextile fabric in the longest continuous practical length, free from tension, stress, folds, wrinkles and creases.

.4 For rip rap on cell slopes:

.1 Install geotextile fabric perpendicular to the cell berm in continuous lengths down the slope. Install geotextile fabric free from tension, stress, folds, wrinkles, and creases.

.5 Install geotextile fabric in accordance with this specification and as per the manufacturer's recommended installation procedures. Manufacturer's recommendations shall take precedence over the specifications.

.6 Overlap joints a minimum of 600 mm or as recommended by the manufacturer whichever is greater.

.7 Cut or fold geotextile fabric to conform to curves and interior corners of cells.

.8 Construction vehicles shall not be permitted to directly drive on the geotextile fabric.

3.3 Rip Rap Placing

.1 Place rip rap in location and to thickness as indicated on the Drawings.

.2 Do not dump rip rap at the top of the slope for downslope pushing into place.

.3 Intermix the rip rap material to uniformly distribute the larger size material and utilize small size material to fill in the void spaces resulting in a well – keyed, void free, stable surface with a consistent gradation. Ensure the segregation does not occur during placement.

.4 Do not dislodge or tear geotextile fabric during the placement of rip rap. If damage occurs repair as an incidental to the works.

.5 Ensure the completed rip rap placed is stable with no tendency to slide.

.6 Sufficient hand work shall be completed to obtain a neat and uniform surface.

END OF SECTION

FORCEMAINS

1. GENERAL

1.1 Scope of Work

.1 The Work of this Section outlines the requirements for the construction of the 200 mm and 150 mm diameter forcemain piping to the limits shown on the Drawings.

1.2 Sampling

.1 At least four (4) weeks prior to commencing Work, inform Contract Administrator of proposed source of bedding materials and provide access for sampling.

1.3 Material Certification

.1 At least two (2) weeks prior to commencing Work, submit Manufacturer's test data and certification that pipe materials meet requirements of this Section. Include Manufacturer's Drawings, information and Shop Drawings where pertinent.

1.4 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01300 – Submittals.

1.5 Record Drawings

.1 Provide data necessary to produce record Drawings showing locations of all mains and appurtenances, including directions for operating valves, list of equipment required to operate valves, details of pipe material, and location of air and vacuum release valves.

2. PRODUCTS

2.1 Forcemain Pipe and Fittings

.1 PVC to AWWA C-900, DR-25 Class 100 or approved equal. All pipe shall be certified by CSA and ULC as being made in accordance to their specifications and stamped accordingly with the CSA logo and ULC logo. Pipe to be made to CSA B137.3, ULC and NSF Standard 14 and 61.

.2 Gaskets to be in accordance with ASTM F477 and to be permanently inserted and fastened at the factory.

.3 Pipe to have insertion depth markings for spigot.

.4 Fittings: - PVC injection moulded fittings to AWWA C907 and of the same materials as the pipe. PVC fabricated fittings for 250 mm and 300 mm tees, elbows, crosses, reducers and caps. PVC fabricated fittings to be fabricated with DR 18, AWWA C 900 pipe with fibreglass-reinforced-polyester over wrap.

2.2 Gate Valves and Valve Boxes

.1 To AWWA C509, standard iron body, resilient seated wedge gate valve with non-rising stem, suitable for 1 MPa with joints to match pipe selected.

.2 Valve body to be epoxy coated in accordance with AWWA C550

.3 Valves to open counter clockwise with red operating nut.

.4 Valve boxes to ASTM A 48 cast iron, bituminous coated, two-piece sliding type adjustable over a minimum of 450 mm complete with valve operating extension rod, of such length that when set on valve operating nut top of rod will be between 150 mm and 450 mm below cover. Top of box to be marked "S".

.5 Acceptable Manufacturer's

.1 Clow Valve Co.

.2 Approved Equivalent

2.3 Butterfly Valve

.1 General:

.1 Valves specified as AWWA C504 to be in full compliance with AWWA C504 and following requirements:

.1 Suitable for throttling operations and infrequent operation after periods of inactivity.

.2 Elastomer seats bonded or vulcanized to body shall have adhesive integrity of bond between seat and body assured by testing, with minimum 75-pound pull in accordance with ASTM D429, Method B.

.3 Bubble-tight with rated pressure applied from either side.

.4 No travel stops for disc on interior of body.

.5 Self-adjusting V-type or O-ring shaft seals.

.6 Isolate metal-to-metal thrust bearing surfaces from flowstream.

.7 Stainless steel disc or disc with stainless steel disc edge.

.2 Type V500 Butterfly Valve 75 mm to 1800 mm:

.1 Flanged end, short body type.

.2 AWWA C504, Class 150B.

.3 Cast iron body, cast or ductile iron disc with Type 304 stainless steel shaft, EPDM rubber seat bonded or molded in body only, and stainless steel seating surface.

.4 Painting and Coating

.1 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.

.2 Interior coatings shall comply with ANSI/NSF 61 "Drinking Water System Components – Heath Effects"

.3 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. Application as per manufacturer's recommendations.

.4 Coatings shall be holiday free as defined in Section 5.2.3 of AWWA Standard C550.

.5 Exterior surfaces shall be painted consistent with interior surfaces.

.6 Surfaces shall be prepared to NACE SSPC-SP10- Near-White Metal Blast Cleaning

.7 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.

.5 Manufacturers and Products:

.1 Pratt

.2 DeZurik

.3 Val-Matic

2.4 Air and Vacuum Release Valves

.1 Air release valves: Use Apco Model 400, 50 mm NPT or approved equal. Valves to be fabricated of cast iron body and cover, with bronze mechanism and seat, stainless steel lever, rod, and float, with shock-proof synthetic seat suitable for 2 MPa working pressure. Valves to be designed to operate (open) while pressurized allowing entrained air in sewage to escape through the air release orifice without spillage or spurt. Provide inlet and blow off valves, quick disconnect couplings and minimum 3 m of hose for flushing. Unit to be rated for operating range of 0 to 350 kPa. Equip valve and hose with quick disconnect couplings. Valves accessories to be as per the following:

.1 Ball Valve: Ford angle ball service valve BA11-333 or approved equal.

.2 Couplings: Ford pack joint coupling C84-333 or approved equal.

.3 Saddles: Dresser Style 91 or Robar 2706 Service Saddle.

.2 Air and vacuum release valves: Use Apco Model 401, 50 mm NPT or approved equal. Valves to be fabricated of cast iron body and cover, with bronze trim, stainless steel floats with shock-proof synthetic seat suitable for 2 MPa working pressure. Valves shall permit venting of air at high rate during filling, and venting at low rate during operation and permit unrestricted entry of air under vacuum conditions. Valves to be heavy duty combination air release valves employing direct acting kinetic principle. Valve to be complete with surge check unit. Ends to be flanged to match pipeline flanges. Provide inlet and blow off valves, quick disconnect couplings and minimum 3 m of hose for flushing. Unit to be rated for operating range of 0 to 1034 kPa. Equip valve and hose with quick disconnect couplings.

2.5 Couplings

.1 Unless specified otherwise all coupling shall be as per City of Winnipeg Standard Construction specification AT-4.1.1.63.

.2 PVC Type - to be bell x bell to the same rating as the pipe

.3 C900 -DR18 and conforming to AWWA C907-91. Each PVC coupling shall marked in accordance with AWWA C-907-91, bear Manufacturer’s production code including date, plant and extruder of Manufacturer. Couplers to also be certified NSF, CAN3-B-137.2-M98, FM, and ULC approved. Coupling to incorporate elastomeric gaskets conforming to AWWA C907-91.

.4 Mechanical Coupler materials to be epoxy coated Cast Ductile Iron, stainless steel T304 or approved alternate. For Polyethylene pipe utilize stainless steel stiffening inserts as recommended by manufacturer. Submit written Manufacturer's recommendations for type of connection to be completed for review and approval of the Contract Administrator.

3. EXECUTION

3.1 Preparation

.1 Clean pipes, fittings, valves and appurtenances of accumulated debris and water before installation. Inspect materials for defects. Remove defective materials from site.

3.2 Trenching, Bedding, and Backfill

.1 Do trenching, bedding, backfill and compaction Work to City of Winnipeg Standard Construction Specifications unless specified otherwise.

.2 Trench line and depth require approval prior to placing bedding material and pipe. Ensure foundation is adequate to receive bedding and pipe. Replace unsuitable material if required

.3 Bed pipes to details indicated. Bedding to include prepared foundation, bedding under pipe, haunching and initial backfill to a height of 200 mm above the top of pipe.

.4 Use Type 2 or Type 3 bedding sand in lieu of granular material as directed by the Contract Administrator.

3.3 Trenching Shoring

.1 Complete trenching and backfill in accordance with Section 02223 – Excavating, Trenching, and Backfilling.

.2 Shoring to be in accordance with the Province of Manitoba "W210 The Workplace Safety and Health Act" and "Guidelines for Excavation Work".

.3 Take special care when a prefabricated cage or shield is used in the trench to ensure that there is no lateral or longitudinal movement of the pipe when the cage is moved.

3.4 Installation in a Trench

.1 Place pipe on compacted bedding ensuring uniform support under bell and pipe body throughout it full length

.2 Work and compact bedding material under side of pipe to provide proper haunching.

.3 Protect exposed pipe ends with an approved plug to prevent excess amounts of water and foreign material from entering pipe as the Work proceeds.

.4 Pipe joint deflection to be within Manufacturer's recommendations.

.5 Install piping to lines and grades indicated on the plans or as directed by the Contract Administrator within a horizontal and vertical tolerance of ± 100 mm. Pipe shall not be placed uniformly high or low.

3.5 Pipe Installation

.1 Lay and join pipes in accordance with applicable AWWA specification for type of pipe selected and latest Manufacturer's standard instructions and specifications.

.2 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends. Do not drag pipe in a manner which may scratch or otherwise damage the pipe.

.3 Prior to installation clean the interior of all pipes and appurtenances of dirt and foreign material and wipe dry.

.4 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever Work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.5 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time and entry of foreign material.

.6 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows undue settlement after installation.

.7 Do not exceed permissible deflection at joints as recommended by pipe Manufacturer.

.8 Cut pipes as required for specials, fittings or closure pieces, in a neat manner as recommended by pipe Manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe. Minimum length of cut pipe to be 1.0 m.

.9 Position and join pipes with approved equipment utilizing hand slings or crane during lowering as required.

.1 PVC Pipe Joints

.1 Install gaskets to Manufacturer's recommendations. Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.2 If cutting PVC bevel edges, per Manufacturer's instructions, for easy insertion into socket.

.3 Apply sufficient pressure in making joints to ensure that joint is completed to Manufacturer's recommendations. Do not use excavating equipment to force pipe section together. Complete each joint before laying next length of pipe.

.4 Minimize deflection after joint has been made. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.5 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.

.6 Recheck any joints assembled above ground after placing in trench to ensure that no movement of joint has taken place and pipes are still fully connected.

.7 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes.

.8 Do not lay pipe on frozen bedding. Protect hydrants, valves and appurtenances from freezing.

.9 Upon completion of pipe laying and after Contract Administrator has reviewed for general conformance work in place, surround and cover pipes with approved material in accordance to City of Winnipeg Standard Specifications CW 2030.

.10 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

3.6 Thrust Blocks

.1 Refer to City of Winnipeg Standard Construction Specification Standard detail SD-004 and SD-005.

3.7 Gate Valves and Valve Boxes

.1 Install valves to Manufacturer's recommendations at locations indicated. Ensure valve box adjustable range is suitable for pipe burial depth.

.2 Support buried valves by means of either concrete or wood blocks, located between valve and solid ground.

.3 Set valve and valve box plumb, centred on valve and set top of box at finished grade or adjust as directed by the Contract Administrator. Provide valve extension in valve box.

.4 Install stone catchers 250 to 350 mm below top of valve box covers.

.5 Install valve box lids that are marked "S" for sewer or "W" for water as applicable.

3.8 Insulation

.1 Obtain approval from the Contract Administrator prior to deviating from the specified depth. If approval has been obtained from the Contract Administrator, Contractor to be responsible for purchasing and installing the insulation as an incidental to the Works.

.2 Install a minimum of 50 mm thick insulated box around piping or as directed by the Contract Administrator.

3.9 Hydrostatic Leakage Testing

.1 After the system has been installed and backfilled to the satisfaction of the Contract Administrator, pressure test the system. Test piping in sections not exceeding 700 m in length or between successive valves unless otherwise authorized by the Contract Administrator.

.2 Provide labour, equipment and materials required to perform hydrostatic leakage tests hereinafter described. Ensure system will pass test prior to requesting Contract Administrator to witness test.

.3 Notify Contract Administrator at least two (2) working days in advance of all proposed tests. Perform tests in presence of Contract Administrator.

.4 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least five (5) days after placing concrete or two (2) days if high early strength concrete is used.

.5 Open mainline valves.

.6 Expel air from main by slowly filling main with potable water and complete flushing by running water to waste. Install temporary or use existing mainline access points as required for flushing and testing. Obtain Contract Administrator's approval for location of mainline access points.

.7 In preparation for the pressure test, after pressurizing the mainline to the test pressure, bleed off the quantity of water equivalent to allowable leakage or 20 L, whichever is less. Bleed location to be remote from the gauge location. Verify that the pressure indicated on the gauge drops the corresponding amount to provide an indication that all air has been bled from the system.

.8 Apply a leakage test pressure of 1,000 kPa, based on the elevation of highest point in main and corrected to elevation of gauge, for a period of two (2) hours.

.9 Leakage is defined as amount of water supplied in order to maintain test pressure for two (2) hours. The pressure shall not drop by more than 2% of test pressure at any time.

.10 Do not exceed allowable leakage as specified below for PVC Piping.

Pipe Diameter (mm)	**Allowable Apparent Leakage L/Hr per 100 Joints Test Pressure 1000 kPa**
150	2.1
200	2.8
250	3.5
300	4.2

.11 No leakage shall be permitted in polyethylene piping.

.12 Locate and repair defects if leakage is greater than amount specified. Report leaks to Contract Administrator prior to excavating to allow Contract Administrator to be On-Site if so desired. Provide written summary of all repair works completed.

.13 Record tests whether acceptable or not on leakage test form City of Winnipeg Standard Construction Specification CW 2125. Sign and submit leakage test form to the Contract Administrator.

.14 Repeat test in the presence of the Contract Administrator until leakage is within specified allowance.

.15 Remove all temporary access points after satisfactorily completion of test and seal holes with brass plugs or as otherwise directed by the Contract Administrator.

END OF SECTION

SUBDRAINS

1. GENERAL

1.1 Scope of Work

.1 The Work of this Section outlines the requirements for construction of the subdrains in the cell floor and includes the requirements for the perforated piping, filter sock, geotextile and washed stone backfill.

1.2 Samples

.1 At least four (4) weeks prior to commencing work, inform the Contract Administrator of proposed source of granular and geotextile materials. Provide access for sampling or if requested provide representative samples to the Contract Administrator for review.

.2 At least two (2) weeks prior to commencing work, submit to Contract Administrator the following samples of materials proposed for use:

.1 Geotextile; sample to be a minimum of 0.3 mm wide x 0.3 m long.

.2 Filter sock; provide 0.3 m length of filter sock

1.3 Material Certification

.1 At least two (2) weeks prior to commencing Work, submit Manufacturer's test data and certification that drain pipe and geotextile materials meet requirements of this section.

.2 For geotextile materials include the latest mill test report. All values must be based on "minimum roll average values" with a minimum of 95% of the fabric supplied exceeding the values specified herein.

.3 Clearly label all rolls of geotextile materials as to product specifications and place of manufacture

1.4 Manufacturer’s Instruction

.1 Make available one (1) copy of Manufacturer's installation instructions.

1.5 Delivery & Storage

.1 During delivery and storage protect geotextiles and filter socks from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

.2 Packaging and labelling according to ASTM standards.

1.6 Record Drawings

.1 Provide data necessary to produce Record Drawings, including details of pipe material, invert elevations, location of tees, bends, connections, and clean-outs.

2. PRODUCTS

2.1 Sub Drain Piping

.1 PVC Pipe and Fittings to ASTM D3034 and CSA Standard B182.1, and B182.2. Use Ipex solvent weld DR 35 piping unless otherwise approved. Number of perforations and spacing shall be as indicated on the Drawings.

2.2 Filter Sock

.1 Filter sock to be non woven geotextile LP4 as supplied by Layfield or approved equal.

2.3 Subdrain Materials

.1 Geotextile shall be nonwoven polypropylene, Geotex 801 as available from Nilex or as approved by the Contract Administrator with the following physical properties:

Physical Property	Requirements	Test Method
Grab Tensile Strength	912 N - minimum	ASTM D-4632
Grab Elongation	50%	ASTM D-4632
Puncture Strength	490 N - minimum	ASTM D-4833
Trapezoid Tear	378 N - minimum	ASTM D-4533
Apparent Opening Size	0.180 mm - maximum	ASTM D-4751
Permittivity	1.5 sec-1 - minimum	ASTM D-4491
UV Resistance	70 % per 500 hours - minimum	ASTM D-4355
Mullen Burst	2,413 Kpa - minimum	ASTM D-3786

Note: All physical properties are to be minimum average roll values based in accordance with ASTM 4759

.2 Granular material to be uniformly graded hard, dense, durable, free draining washed stone ranging from 5 mm to 16 mm in size. Submit sieve analysis for selected material for review and approval.

3. EXECUTION

3.1 Preparation

.1 Clean pipes and fittings of debris, dirt, mud, ice, and snow before installation. Inspect materials for defects before installing. Remove defective materials from Site.

3.2 Trenching, Bedding, and Backfill

.1 Do trenching and backfill in accordance with the City of Winnipeg's Standard Construction Specifications unless specified differently.

.2 Trench line and depth require approval prior to placing geotextile, bedding material, and pipe.

.3 Do not proceed with bedding operations until Contract Administrator has reviewed installations.

.4 Do not backfill trenches until pipe grade and alignment have been checked.

.5 Utilize approved subdrain granular material (washed stone) for bedding and backfill.

3.3 PVC Solvent Weld Joints

.1 Cut end of pipe square; remove all burs from the inside and outside of the pipe with a file. Cut 15° chamfer to a depth of 2.5 mm. Clean pipe with a clean, dry rag.

.2 Check pipe and fittings for dry fit prior to commencing solvent welding operations. Ensure pipe fully bottoms in the socket with no interference but without excessive tolerance. Use roller applicator for pipe sizes 100 mm or greater in diameter to apply primers and cement.

.3 Apply primer freely to fitting socket keeping the surface wet for minimum 10 to 15 seconds. Remove puddling by tilting the socket to allow excess to run to waste. Apply primer to the pipe in the same manner as the socket. A second application of primer in the socket is required if the fitting surface is especially hard.

.4 Immediately and while surfaces are still wet apply appropriate PVC cement with the appropriate applicator. Cement must be in a fluid condition.

.5 Apply a medium layer of cement to the fitting socket; avoiding puddling cement in the socket. Apply a second full layer of cement to the pipe.

.6 Assemble the pipe and fitting without delay while cement is wet. Ensure the pipe bottoms in the fitting socket. If possible, twist the pipe $^{1}/_{8}$ to $^{1}/_{4}$ turn after insertion. Maintain pipe and socket under insertion pressure for 15 to 30 seconds to eliminate push out.

.7 Inspect connect to verify a consistent bead of cement around the junction of the pipe and fitting. If consistent bead is not present joint may be deemed defective by the Contract Administrator.

.8 Handle newly assembled joints carefully until initial set has taken place. Initial set times are one (1) hour for temperatures above 15°C and four (4) hours for temperatures between 5 and 15°C.

3.4 Alignment

.1 Install subdrain pipe to the line and grade shown on the Drawings or as directed by the Contract Administrator.

.2 Ensure horizontal variance from line does not exceed ± 100 mm.

.3 Allowable vertical variance from specified grade to be not more than ± 25 mm. Provide positive grade along lagoon cell floor to collection headers.

3.5 Subdrain Installation

.1 Do not proceed with placement of geotextile until Contract Administrator has reviewed trenching works.

.2 Place geotextile material by unrolling onto graded surface in orientation, manner, and locations indicated. Ensure geotextile is smooth and free of tension stress, folds, wrinkles or creases, upon final placement. Do not drag geotextile on subgrade.

.3 Ensure width of geotextile is sufficient to permit overlap as indicated on the Drawings after placement of the granular subdrain material.

.4 Overlap each successive strip of geotextile a minimum 600 mm (or as recommended by Manufacturer, whichever is greater) over previously laid strip.

.5 Protect geotextile from displacement and damage until and during placement of piping and granular material.

.6 Install subdrain piping on geotextile. Lay drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with bed throughout full length.

.7 Lay and join pipe in accordance with Manufacturer's recommendations. Lay socked perforated pipe with perforations on top. Handle pipe by approved methods.

.8 Install PVC pipe and fittings in accordance with CSA B181.12

.9 Commence laying at connection to gravity main and proceed in upstream direction with socket ends of pipe facing upgrade.

.10 Do not exceed maximum joint deflection recommended by pipe Manufacturer.

.11 Do not allow water to flow through pipes during construction except as may be approved by Contract Administrator.

.12 Whenever Work is suspended, install removeable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.13 Protect subdrain piping against flotation during installation.

.14 Install connections to surface as indicated, for flushing.

.15 Cover geotextile and subdrain piping with subdrain granular materials ensuring the drop of the granular material does not damage the fabric. The length of drop shall not exceed 1.0 m.

.16 Place granular subdrain backfill materials in uniform layers not exceeding 150 mm thickness. Complete backfilling and subdrain construction as indicated on the Drawings.

.17 If the geotextile is damaged due to Contractor's operations repair the damaged area to the satisfaction of the Contract Administrator. Use a patch that overlaps damaged area a minimum of 1000 mm in all directions.

.18 Do not permit passage of any vehicle directly on geotextile at any time.

.19 Flush subdrains as per City of Winnipeg Standard Construction Specification Section CW 2125. No disinfection and hydrostatic leakage test is required.

END OF SECTION

PRESERVATION OF TOPSOIL

1. GENERAL

1.1 Scope of Work

.1 The Work of this Section includes excavation of topsoil from designated areas, a partial listing is area for dewatering cells, piping routes, pump station and stockpiling or respreading as directed in the various Specification Sections.

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 Stripping of Topsoil

.1 Remove Topsoil before any construction procedures commence to avoid compaction of Topsoil.

.2 Do not handle Topsoil which is in a wet or frozen condition or in any manner in which soil structure is adversely affected.

.3 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by alternative disposal acceptable to authorities having jurisdiction.

.4 Strip Topsoil to full depth or as directed by Contract Administrator. Avoid mixing Topsoil with subsoil.

.5 Stockpile Topsoil at locations as directed by Contract Administrator. Stockpile height not to exceed 2.5 to 3 m.

.6 Dispose of unused Topsoil in location as indicated by Contract Administrator for later use.

.7 Protect stockpiles from contamination and compaction.

.8 Topsoil that has been piled for long-term storage will be covered with trefoil or grass to maintain agricultural potential of soil.

END OF SECTION

TOPSOIL, MULCHING & SEEDING

1. GENERAL

1.1 Scope of Work

.1 The Work of this Section outlines the requirements for Topsoil replacement for the purpose of grass growth only. Schedule the placing of Topsoil and finish grading to undertake seeding operation under optimum soil moisture conditions and weather conditions.

.2 Another requirement of this Section is the supply and placement of straw mulch on top of new seeding. Straw mulch shall be placed by power mulching and anchored (crimped) into the soil to minimize erosion and promote vegetation growth.

.3 The Contractor shall supply and place straw mulch material immediately after seeding and fertilizer application.

.4 Straw mulch shall be placed ensuring that there is a minimum of 90% ground coverage by area, as measured and accepted by the Contract Administrator.

.5 Mulched areas shall be inspected periodically and after runoff producing storm events. Damaged areas shall be repaired immediately as determined by the Contract Administrator. Any areas requiring reapplication of the straw mulch due to faulty installation or from the Contractor's activities shall be re-mulched and crimped in accordance with this Specification at no cost to City.

2. PRODUCTS

2.1 Grass Seed Mixture

.1 Slopes: Grass seed mixture to be Certified Canada No.1 Grade and as per the following blend:

Creeping Red Fescue – 20%

Smooth Brome – 10%

Meadow Fescue – 10%

Slender Wheatgrass – 15%

Tall Wheatgrass – 15%

Alfalfa (creeping variety) – 15%

Alsike Clover – 5%

Red Clover – 5%

Birdsfoot Trefoil – 5%

.2 Forage Mix – this mixture is to be applied on all disturbed portions of the work area outside the main slopes, including new and reconstructed perimeter ditches. This mixture will generally consist of the following species and approximate proportions:

Smooth Brome – 20%

Meadow Brome – 10%

Timothy – 10%

Orchard Grass – 10%

Alfalfa (tap root variety) – 30%

Alfalfa (creeping variety) – 20%

.3 Oats (Canada No. 1 Grade) to be utilized as a Nurse or Cover Crop.

2.2 Straw Mulch

.1 The material shall consist of wheat or barley straw, or other plants accepted by the Contract Administrator. The straw mulch shall be air dried, reasonably light in colour, and shall not be musty, mouldy, caked, or otherwise of low quality. The mulch shall be free of coarse (chaff) material and free of noxious weeds and/or seeds to prevent the introduction of weeds into previously seeded and planted areas. Dry mulching material that breaks down and does not bend will not be acceptable. The power mulching process shall produce a minimum of 75% of the straw being between 150 and 200 mm in length. The Contractor shall submit his proposed source and a sample of the straw material as well as proposed power mulching placement and crimping methods for acceptance

2.3 Fertilizer

.1 Fertilizer shall consist of a 25-40-0 formulation.

3. EXECUTION

3.1 Preparation of Subgrade

.1 Verify the subgrade elevations are within approved tolerances. Do not commence placement of Topsoil until subgrade elevations have been reviewed and approved by the Contract Administrator.

.2 Grade area only when soil is dry to lessen soil compaction.

.3 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage. Ensure soil utilized for Topsoil is free of all debris and deleterious material in excess of 25 mm diameter.

3.2 Placing of Topsoil

.1 Place Topsoil only after Contract Administrator has accepted subgrade. In general Topsoil is to be placed over the inner side slopes above the normal liquid level, top and outer slopes of the dikes and areas extending to the limit of the area affected by excavation Works, and on perimeter ditches.

.2 During dry conditions spread Topsoil in uniform layers to a minimum depth of 75 mm, over unfrozen subgrade free of standing water. If additional Topsoil is available method of disposal of additional Topsoil to be as directed by the Contract Administrator and may consist of either stockpiling in an approved location or spreading to a thickness as directed by the Contract Administrator. If insufficient Topsoil is available, import Topsoil as directed by Contract Administrator.

.3 Establish traffic patterns for equipment that will prevent driving on Topsoil after it has been spread to avoid compaction.

.4 Fine grade entire Topsoiled area to eliminate rough spots and low areas ensuring positive drainage. Grade ditches to depth required for maximum run-off.

.5 Cultivate the area to a depth of 50 mm after completing Topsoil spreading operations.

.6 Obtain Contract Administrator's approval of Topsoil grade and depth before starting seeding.

3.3 Seeding, Fertilizing and Mulching

.1 Seeding shall commence immediately upon completion of earthwork. The seeding operation shall consist of an initial harrowing, application of the seed and fertilizer, and a second harrowing. Straw mulch application and crimping shall follow the second harrowing.

.2 No seeding shall be completed if the work area cannot be covered with straw mulch.

.3 Seeding that is not completed in the fall or winter periods shall be completed the following spring as soon as atmospheric and site conditions allow for seeding operations to commence, as determined by the Contract Administrator.

.4 All weed growth in areas to be seeded shall be destroyed as required so that proper seeding can be done.

.5 The seed bed shall be prepared by harrowing the finished grade prior to seed application.

.6 The seed and Cover Crop seed shall be sown separately utilizing conventional seed drill equipment capable of uniformly applying all species contained within the specified mixtures. Only if the equipment is capable of sufficient adjustment as to ensure uniform application will the Cover Crop seed and the Slope (or Forage) seed be permitted to be mixed and sown together, as accepted by the Contract Administrator. The drill shall accurately and uniformly place the seed (both grass/forage and cover crop) to a depth of 10 to 20 mm. The seed drill

shall be fitted with on-row packers, in order to achieve adequate seed to soil contact. Seed shall not be applied by broadcasting methods unless directed by the Contract Administrator.

.7 Seed shall be sown at 32 kg per hectare rate.

.8 New seeding shall blend applications 300 mm into adjacent grassed areas and previous applications to form uniformly covered surfaces.

.9 Harrowing after the seeding operation shall be undertaken, either as a separate operation or in conjunction with the seeding operation.

.10 In order to discourage down slope erosion, on all sloped areas, the direction of equipment travel for seeding and final harrowing operations must be perpendicular to the slope.

.11 No seeding shall be done on frozen soils, or when any other conditions unfavourable to the successful planting of seed exist, as determined by the Contract Administrator.

.12 Fertilizer shall not be mixed with seed but applied as a separate broadcast operation or by a fertilizer attachment on the seed drill.

.13 The fertilizer application shall achieve a rate of 225 kg/ha (200 lbs/acre).

.14 Rutting or damage caused during seeding and fertilizing operations shall be repaired to the satisfaction of the Contract Administrator.

.15 The straw mulch material shall be spread with power mulching equipment at a rate of 4500 kg/ha, to a layer 25 to 50 mm in thickness. Mulch that remains clumped or bunched after application shall be separated and re-spread. The Contractor shall blow the straw mulch from the top of the side slopes or embankment down slope and from the bottom of the side slope or embankment upslope to ensure uniform coverage.

.16 Crimping or Anchoring of Straw Material: All straw mulch shall be crimped into the ground to a nominal depth of 50 mm.

.17 After spreading of the straw mulch material, the straw mulch shall be crimped or anchored to the ground with a straw crimper (crimp disc). The straw crimper should have a Coulter (serrated) blade spacing between 100 to 200 mm and a blade diameter of +/- 50 cm. The blades should be notched and tapered for easy soil penetration. The roller punching method of straw anchoring will not be accepted.

.18 Crimping shall be completed in two directions perpendicular to each other with the final pass conducted parallel the slope rather than up and down. A minimum of 75% of the straw shall remain visible at ground surface after crimping.

.19 The Contractor shall complete all work necessary to crimp the straw mulch, including but not limited to light discing as required.

.20 The Contract Administrator will provide Final Acceptance of the seeded areas when:

.1 Verification has been made that the seed has been properly applied as per the above Specifications.

.2 Areas have been fertilized.

.3 Final harrowing has been completed on required areas.

END OF SECTION

EXCAVATION, HAULAGE, AND PLACEMENT

1. GENERAL

1.1 Description

.1 Work includes, but is not necessarily limited to the following items:

.1 Excavation, haulage, placing, and compaction of clay material for cells Works to attain indicated grades and profiles including selection of liner soils and construction techniques as required to obtain an impermeable structure (permeability of less than 10^{-7} cm/sec).

.2 If an impermeable structure is not obtained (i.e. soil permeability test results fail to meet the Environmental License requirements); complete all remedial works as may be required to obtain and impermeable structure and permeability results within the Environmental Act License requirements. All remedial Works due to works within the Contractor's control are to be at no charge to the City.

.3 Stripping and stockpiling/replacement of topsoil and spoil excavated material.

.4 Dewatering of excavations.

.5 Complete quality control testing as requested by the Contract Administrator to verify densities and liner permeablities. Extraction of shelby tubes shall be complete utilizing a drill rig and must be in accordance with the Environmental License requirements.

.6 All testing is to be completed by a laboratory approved by the Contract Administrator.

.7 The calculations for earth movement have assumed that all excavated soils including Topsoil including borrow soils is utilized in a cut/fill balance for this project. Thus Topsoil may be utilized on the outside of the dikes to a thickness that is greater than required or stated under other sections of this document (i.e. seeding or on the plans). Thus the Contractor is notified that Topsoil must be stripped in such a manner to efficiently utilize Topsoil in the construction of the outside surfaces of the dikes.

1.2 Definitions

.1 Suitable material: relatively impermeable material free of detrimental amounts of sod, roots, frozen soil, stones, and other objectionable material, that is suitable to use in the work to construct dikes and embankments.

.2 Borrow material: acceptable material obtained from locations outside area to be graded, and required for construction of fill areas or other portions of the Work.

.3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.4 Unsuitable material: compressible (peaty organic type), frost susceptible (fine grained material with plasticity index less than 1 tested per ASTM D 4318) material.

.5 Embankment: selected material from usable excavation placed above original ground or stripped surface up to top of berm or dike elevation.

.6 Keyway / Cut Off: an impervious layer, as indicated on the Drawings, constructed from selected clay materials with a permeability of less than 10^{-7} cm/sec.

.7 Clay Core: an impervious portion of the berm or dike, as indicated on the Drawings, constructed from selected clay materials with a permeability of less than 10^{-7} cm/sec.

.8 Free Haul: Distance that excavated material is to be hauled without compensation. Free haul distance to be within 1000 m of the general work site.

.9 Overhaul: authorized hauling in excess of free haul distance that excavated material is moved.

.10 Subgrade: original ground surface or prepared surface upon which embankments are constructed.

1.3 Clay Liner Requirements

.1 The clay liner requirements for this project as follows:

.1 Remove all organic topsoil/material from the area where the cells shall be constructed.

.2 Construct the cells with a continuous clay liner under all interior surfaces of the structure in accordance with the following specifications:

.1 The liner shall be constructed of clay.

.2 The liner shall be at least 1 m thick and more as specified on Drawings.

.3 The liner shall have a hydraulic conductivity of 1×10^{-7} cm/sec or less.

1.4 Soil Types and Conditions

.1 The cells shall be constructed with a continuous 1 m or more thick clay liner under all interior surfaces of the structure, the liner is to have a permeability of less than 10^{-7}cm/sec and be the full height of the dike.

.2 Ensure construction techniques and compaction requirements to place and compact the best available soil types (whether existing onsite or from local borrow stockpiles) to obtain an impermeable structure (permeability of less than 10^{-7}cm/sec).

.3 Be responsible for selecting and placing soils to obtain a structure with a permeability of less than 10^{-7} cm/sec. Should soil permeability test results fail to meet the Environmental License; Contractor to correct all works as may be required to obtain permeability results within the Environmental License. All remedial works due to works within the Contractor's control are to be at no charge to the City.

.4 The Contractor shall make his own inspection of the type and moisture conditions of the soil to be excavated and compacted.

.5 The Contractor shall ensure that soil moisture conditions are suitable so as to attain the densities as specified. Dry soils by draining excess water, pumping water, reworking soil, or installing temporary sumps, etc. if groundwater conditions adversely effect soil moisture conditions or if such methods are requested by the Contract Administrator.

1.5 Borrow Material

.1 If required, borrow material for the liner construction is available from existing surplus soil stockpiles On-Site. Be responsible for selecting and placing soils from the surplus soil stockpile to obtain a structure with a permeability of less than 10^{-7} cm/sec.

1.6 Reference Standards

.1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).

.2 ASTM D5084, Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter - Triaxial Test Method.

.3 ASTM D 1587 Standard Practice for Thin Walled Tube Sampling of Soils

.4 D 4220 Standard Practice for Preserving and Transporting Soil Samples

.5 D 3550 Standard Practice for Ring-Lines Barrel Sampling of Soils

2. PRODUCTS

2.1 Materials

.1 All materials to be subject to Contract Administrator's review.

.2 Liner materials use selected clay type soils with a permeability of less than 10^{-7} cm/sec

.3 Embankment materials (not including liner materials) to consist of suitable material free of frozen lumps, organic material (sod, roots) or other deleterious material.

3. EXECUTION

3.1 Excavation

.1 Commence topsoil stripping from the area of the dewatering cells floor and dikes as per directed by the Contract Administrator. Complete topsoil removal as per Section 02650 – Preservation of Topsoil**.**

.2 Excavate to lines and grades as indicated on the Drawings or as directed by the Contract Administrator. Stockpile waste/unsuitable material On-Site as directed by the Contract Administrator.

.3 Local pockets of material that, in the opinion of the Contract Administrator, are unsuitable, shall be removed to such depths as required by the Contract Administrator.

.4 If encountered, remove stones, rubbles, concrete, and other obstructions during excavation.

.5 Do not obstruct flow of surface drainage or natural water courses during excavation Works.

.6 The completed excavation shall provide clean, level, solid, and water-free surfaces.

.7 Areas used for temporary stockpiling shall be restored to existing condition or better.

.8 Make good all damage occurring as a result of inadequate, unauthorized, or defective methods of protection at no cost to the City.

.9 Advise Contract Administrator sufficiently in advance of excavation operations for initial cross-sections to be taken.

3.2 Dewatering Cells Construction

.1 Construct liner and dikes to lines and grades as indicated on the Drawings.

.2 A liner shall be a minimum of 1.0 m thick and constructed of excavated and re-compacted clay types soils. Place liner material in layers of 150 mm compacted thickness to minimum of 95% of Standard Proctor Maximum Dry Density. Only high plastic, impervious clay type soils to obtain a structure with a permeability of less than 10^{-7} cm/sec shall be used for liner construction.

.3 All material must be placed in an unfrozen condition and no material shall be placed on frozen surfaces.

.4 Construct the dewatering cells dikes construction from suitable materials. Material utilized in dike construction shall be homogeneous and shall contain no lenses, pockets, streaks, or layers of material differing substantially in texture or gradation. Dispose of unsuitable materials as directed by the Contract Administrator.

.5 During excavation, all sand/silt pockets shall be removed as unsuitable material.

.6 Unsuitable material (i.e. sand, silt pockets, silty, or granular soils, etc.) that are encountered during excavation works shall be disposed of as directed by the Contract Administrator. Sand, silt, and granular soils may be blended with clay type soils and utilized in the exterior dike slopes if approved by the Contract Administrator.

.7 If seams of unsuitable material are encounter in the cell floor complete test holes to determine the direction/location and extent of the seam. The Contract Administrator may

request depending upon the direction and location of the seam that the soil be removed to a suitable depth and replaced with a compacted clay layer to provide an impermeable seal.

.8 Place dike materials (non-core material) in layers of 150 mm compacted thickness. Compact each layer to minimum 95% Standard Proctor Maximum Dry Density.

.9 All subgrade prepration shall be as per the City of Winnipeg Standard Construction Specifications CW 3110. If the subgrade conditions are wet, geotextile layer shall be installed prior to soil placement as per City of Winnipeg Standard Construction Specifications CW 3130. The initial lifts of fill may need to be thicker than the specified minimum 150 mm to bridge the soft subgrade.

.10 Finish slopes, top of dike, and cell bottom to within a 50 mm tolerance of lines, contours, and grades as indicated on the Drawings or as directed by the Contract Administrator. Finished elevations shall not be shall not be uniformly high or low. Hand finish or grade slopes and top of completed dike to remove stones over 12 mm in size and other debris.

.11 Extreme caution shall be exercised during backfill and compaction around structures, piping, or conduits to prevent damage, movement, or deflection. All intrusions into the clay liner will be backfilled and compacted to like conditions of the surrounding clay liner to maintain its integrity.

.12 Apply topsoil and seed in accordance with other Sections of the Specification and per City of Winnipeg Standard Construction Specification CW 3520 for unspecified components.

3.3 Compaction

.1 Each layer shall be compacted with a minimum six (6) passes of tamping-type roller (sheepsfoot roller or wedgefoot drum rollers machine). Complete additional roller passes as required to obtain specified compaction. The tamping-type roller shall have tampers or feet projecting not less than 150 mm from the surface of the drum and shall have a minimum static load on each tamper of 1723 kPa (250 lbs per square inch) of tamping area. Operation of the roller shall be continuous over the entire area during earth moving operations. All material shall be placed to act as an impermeable barrier. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 100 mm before next layer is placed.

.2 The material shall not be so wet nor so dry that compaction equipment cannot compact the fill into a homogeneous mass. The moisture content of the material shall be within the range of 0.0 to 2.0 % wet of optimum in accordance with CW 3170. Clay fill shall not be compacted dry of optimum moisture content.

.3 Material too dry shall be scarified and wetted as directed by the Contract Administrator to obtain the required moisture content for compaction. Providing water to attain adequate compaction of the soil liner shall be incidental to the works.

.4 Material too wet shall be dried by disking and reworking or wasted as directed by the Contract Administrator to obtain the required moisture content for compaction. Dewatering and drying of soils shall be considered as an incidental to the works.

3.4 Perimeter Ditching

.1 Construct perimeter ditches to the lines and grades as shown on the plans or as directed by the Contract Administrator.

3.5 Testing

.1 Testing laboratory to be approved by the Contract Administrator. Submit for Contract Administrator's documentation of proposed laboratory and laboratory's ability to complete tests in conformance with related standard to the Contract Administrator for review and approval.

.2 Supply all materials and equipment necessary to complete density testing, and shelby tube soil sample collection at the required depth. Sample depth to be as directed by Manitoba Conservation or as determined by the Contract Administrator. Upon extraction of the soil samples, samples shall be forwarded to the appointed laboratory for testing. All cost associated with the tests shall be the Contractor’s responsibility.

.3 All testing and soil sampling shall be conducted in accordance with most recent applicable standards. All sample holes shall be sealed with bentonite pellets after the field drilling and sampling has been completed.

.4 Location and number of density tests to be as determined by the Contract Administrator based on his evaluation of site conditions at the time of construction. Notify Contract Administrator sufficiently in advance of operations to allow for scheduling of tests with laboratory personnel. Each lift shall be tested in conformance with CW 3170.

.5 Submit soil samples as required for testing to the testing laboratory in a timely manner to ensure no delays are caused in the Work.

.6 Soil sampling for permeability testing is to be completed between May 15 and October 15, if soil sampling is proposed beyond this time frame obtain approval from Manitoba Conservation. Contractor shall be responsible to arrange and schedule drill rig, testing personnel, and coordinating the attendance of Manitoba Conservation personnel. Promptly report all test results to the Contract Administrator.

.7 Complete Shelby Tube soil sampling at locations directed by Manitoba Conservation representative and/or Contract Administrator. The drill rig shall have the capacity to drill to the maximum depth of the liner plus an additional 2 m. The drill rig shall be equipped with both standard and hollow stem augers and capable of inserting the Shelby sampling tube in a straight line motion along the center axis line of the tube without lateral displacement. The minimum hole diameter shall be 125 mm.

.8 Record test hole logs indicating soil type, depth, and locations of each drill hole. Shelby tube soil samples shall be labelled to identify sample number, location and depth of sample, and date taken. Seal soil samples and deliver to the testing laboratory. Number of samples to be tested as determined by Manitoba Conservation and / or the Contract Administrator. Submit a "sealed" laboratory report of permeability test results to the Contract Administrator.

.9 Where test results by the designated testing laboratory indicates that the Work is in nonconformance with the plans and Specifications, complete all remedial Work as required to bring Works into conformance with the Specifications. Contractor is to bear all costs for remedial Works, and re-testing until acceptable test results are achieved when nonconformance is due to Works within the Contractor's control.

3.6 Surplus Material

.1 Stockpile all surplus material in a location as shown on the Drawings and as approved by the Contract Administrator.

.2 Trim and shape all surplus material in the pile after construction is complete. In general the stockpile must be able to be maintained by mowing equipment. Obtain Contract Administrator's approval of final shape.

.3 Dispose of surplus material not required for fine grading and landscaping or embankment construction as directed by Contract Administrator.

3.7 Road Embankment

.1 Construct road embankments to the lines and grades shown on the plans. Utilize suitable common excavated material approved by the Contract Administrator. Road embankments shall be constructed in lifts of maximum 150 mm thickness.

3.8 Clean-Up

.1 Remove surplus material and debris from Site. Dispose in accordance with the environmental guidelines and authorities having jurisdiction.

END OF SECTION

CONCRETE FORMWORK

1. GENERAL

1.1 Work Included

.1 Forms for all concrete and supporting falsework including design.

.2 Formliner for all wall surfaces in contact with waste water in the cells.

.3 Wood or steel forms for all cast-in-place concrete.

.4 Void forms between structural elements and soil below.

.5 Shoring, bracing, and anchorage.

.6 Form openings for other trades.

.7 Coordinate installation of concrete accessories.

.8 Set anchor bolts, anchors, sleeves, frames, and other items supplied by other trades.

.9 Clean erected formwork prior to concrete placement.

.10 Remove forms and supporting falsework.

1.2 Design Standards

.1 Design and detail forms and supporting falsework in accordance with the NBC, CSA CAN/CSA-A23.1-00, CSA S269.1, CAN/CSA S269-3, ACI 347R, and applicable construction safety regulations.

.2 Design to be done by a Professional Structural Engineer, registered in the Province of Manitoba.

1.3 Quality Assurance

.1 Construct and erect concrete formwork in accordance with CAN/CSA-A23.1-00, CAN/CSA S269.3, ACI 347R, and all applicable construction safety regulations for the place of Work.

1.4 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01300 – Submittals.

.2 Clearly indicate sizes, methods of construction, materials, arrangement of joints, ties and shores, location and size of falsework, schedule of erection and stripping, reshoring, etc.

.3 Shop Drawings and design briefs are to bear the seal of a Professional Engineer, registered in the Province of Manitoba.

.4 Formwork, falsework, and reshoring are to be reviewed by the same Professional Engineer prior to each concrete pour.

.5 Professional Engineer to report, in writing, that reviewed formwork, falsework, and reshoring are in accordance with the design prior to each concrete pour.

2. PRODUCTS

2.1 Exposed Surfaces

.1 Square-edged, smooth surfaced panels true in plane, free of holes, surface markings, or defects.

2.2 Unexposed Surfaces

.1 Square-edged T&G lumber, plywood or other material, suitable to retain concrete without leakage or distortion.

2.3 Wood Materials

.1 Plywood: douglas fir, conforming to CSA O121-M solid one side, sheathing grade. Sound undamaged sheets with clean true edges.

.2 Lumber: conforming to CSA O141-M.

.3 Nails, Spikes and Staples: galvanized; conforming to CSA B111.

2.4 Prefabricated Forms

.1 Steel Type: minimum 1.6 mm steel thickness; well matched, tight fitting, and adequately stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surface.

.2 Solid Foam Void Forms: expanded polystyrene, structurally sufficient to support weight of reinforcing steel, wet concrete mix, and a minimum of 2.4 kPa construction live load, until initial set. The depth of collapse shall be a minimum of 200 mm. Acceptable product is GeoSpan by Plasti-Fab Ltd. Protection shall be one (1) layer of 12.7 mms thick spruce plywood sheeting.

.3 Paper Void Forms: moisture resistant treated paper faces, bio-degradable, structurally sufficient to support weight of wet concrete mix and a minimum of 2.4 kPa construction live load until initial set.

2.5 Accessories

.1 Plain Form Liner: acceptable product is Zemdrain MD-2 by Dupont complete with drainage profile on exterior surface of the form liner. Alternate products with proven performance, equal to that of the design standards, are subject to acceptance by the Contract Administrator.

.2 Form Ties: removable snap-off metal type, galvanized, fixed length, minimum working strength of 13 kN when assembled. For water retaining structures use form ties that leave a minimum cutback of 50 mm. Form tie systems with sleeves will not be permitted for water retaining structures or structures immersed in water. For non-water retaining structures use minimum 25 mm deep plastic cone snap type or screw type on exposed surfaces. Wire ties are not permitted.

.3 Form Release Agent: colourless mineral oil which will not stain concrete or impair natural bonding or colour characteristics of coating intended for use on concrete.

.4 Corner or Chamfer Fillets: mill finished pine, widths as indicated on the Drawings, maximum possible lengths, mitre ends.

.5 Reglets: mill finished pine, shaped to required cross-section, maximum possible lengths, mitre ends.

.6 Sealing Tape: reinforced, self-adhesive, waterproof kraft.

3. EXECUTION

3.1 Erection

.1 Verify lines, levels, and centres before proceeding with formwork. Ensure dimensions agree with Drawings.

.2 Construct formwork and falsework to meet design and regulatory requirements, and to produce finished concrete conforming to surfaces, shapes, lines, and dimensions indicated on Drawings.

.3 Arrange and assemble formwork to permit removal without damage to concrete.

.4 Align joints and make watertight to prevent leakage of cement paste and disfiguration of concrete. Keep form joints to a minimum. Tape as necessary.

.5 Arrange forms to allow removal without removal of principal shores, where these are required to remain in place.

.6 Obtain Contract Administrator's acceptance before framing openings in concrete slabs, walls, beams, and columns not indicated on Drawings.

.7 Provide falsework to ensure stability of formwork. Brace or strengthen all previously constructed parts liable to be overstressed by construction loads.

.8 Position form joints to suit any expressed lines required in exposed concrete.

.9 Provide chamfer on all internal and external corners and edges, vertical and horizontal, of exposed concrete unless shown otherwise.

.10 Form chases, slots, openings, drips, and recesses as detailed on Drawings.

.11 Set screeds with top edge level to required elevations.

.12 Check and readjust formwork to required lines and levels during placing of concrete.

.13 Locate construction joints for beams and suspended slabs where shown or noted on the Drawings.

.14 Provide reveals or reglets on construction joints as shown on the Drawings.

3.2 Void Form

.1 Void forms shall be placed on prepared surfaces of levelling sand so that the top of the void forms present flat forming surfaces.

3.3 Tolerance

.1 Construct formwork to produce concrete with dimensions, lines, and levels within tolerances specified in ACI 347R, Guide to Formwork for Concrete.

3.4 Inserts/Embedded Items/Openings

.1 Provide formed openings where required for pipes, conduits, sleeves, and other Work to be embedded in and passing through concrete members.

.2 Accurately locate and set in place items which are to be cast directly into concrete.

.3 Coordinate Work of other Sections and cooperate with trades involved in forming openings, slots, recesses, chases, and setting sleeves, bolts, anchors, and other inserts.

.4 Coordinate installation of concrete accessories specified in Section 03250 – Concrete Accessories.

.5 Provide temporary ports or openings in formwork where required to facilitate cleaning and construction review. Locate openings at bottom of forms to allow flushing water to drain.

.6 Close temporary ports or openings with tight fitting panels, flush with inside face of forms, neatly fitted so no leakage occurs, and to provide uniform surface on exposed concrete.

3.5 Field Quality Control

.1 Inspect and check complete formwork, falsework, shoring, and bracing to ensure that Work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and parts are secure. Submit written report from Professional Engineer registered in the Province of Manitoba responsible for this Work as specified in Clause 1.4 Shop Drawings.

.2 Inform Contract Administrator when formwork is complete and has been cleaned, to allow for review. Contract Administrator's review will be for verification that forms are clean and free from debris.

.3 Allow Contract Administrator to review each section of formwork prior to re-use. Formwork may be re-used if acceptable to the Contract Administrator.

3.6 Cleaning

.1 Clean forms to remove foreign matter as erection proceeds. Remove cuttings, shavings, and debris from within forms. Flush completely with water to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

.2 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 Formwork Preparation

.1 Apply form release agent in accordance with Manufacturer's recommendations, prior to placing reinforcing steel, anchoring devices, and embedded parts.

.2 Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces moist prior to placing concrete.

.3 Form liner shall be used on all water retaining wall surfaces and exterior wall surfaces of structures immersed in waste water as indicated on the Drawings. The form liner shall be installed in strict accordance with the Manufacturer's instructions. The Manufacturer's Representative shall be on-Site at the beginning of the formliner installation and as required to ensure recommended procedures are followed. Wrinkles or folding of the formliner during concrete placement will not be accepted.

3.8 Form Removal

.1 Notify Contract Administrator prior to removing formwork.

.2 Do not remove forms and falsework until concrete has gained sufficient strength to carry its own weight plus construction and design loads that are liable to be imposed. Verify strength of concrete by compression tests to satisfaction of Contract Administrator.

.3 Forms shall remain in place a minimum of two (2) days and the concrete shall have attained 75% of design strength verified by field cured test cylinders.

.4 Remove falsework progressively, in accordance with regulatory requirements and ensure that no shock loads or imbalanced loads are imposed on structure.

.5 Loosen forms carefully without damaging concrete surfaces. Do not apply tools to exposed concrete surfaces.

.6 If forms are left loosely in place for protection until curing requirements are complete, ensure all concrete surfaces are kept continuously wet with use of soaker hoses. Otherwise remove forms and start wet cure immediately by use of soaker hoses or accepted curing compound.

3.9 Reshoring

.1 If reshoring is required, prepare and submit a schedule to Contract Administrator for review.

.2 Reshore structural members where required due to design requirements or construction conditions under the direction of the Professional Engineer responsible for this Work.

.3 Install reshoring as required to permit progressive construction.

END OF SECTION

CONCRETE REINFORCEMENT

1. GENERAL

1.1 Work Included

.1 Reinforcing steel bars for cast-in-place concrete complete with tie wire.

.2 Support chairs, bolsters, bar supports, and spacers for reinforcing.

.3 Positioning pins for precast concrete walkway panels.

1.2 Quality Assurance

.1 Perform concrete reinforcing Work in accordance with Canadian Standards Association CAN/CSA-A23.1-00.

1.3 Inspection and Testing

.1 If requested by Contract Administrator, submit three (3) certified copies of mill test report of reinforcement supplied, indicating physical and chemical analysis.

1.4 Shop Drawings

.1 Submit bar lists and placing drawings in accordance with Section 01300 – Submittals.

.2 Clearly indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric, bending and cutting schedules, and supporting and spacing devices.

.3 Drawings and details to conform to CAN/CSA-A23.1-00, CAN/CSA-A23.3, and RSIC Reinforcing Steel Manual of Standard Practice.

.4 Detail placement of reinforcing where special conditions occur.

.5 Detail lap lengths and bar development lengths to CAN/CSA-A23.1-00, unless otherwise shown on the Drawings.

1.5 Delivery and Storage

.1 Deliver, handle, and store reinforcement in a manner to prevent damage and contamination.

.2 Deliver bars in bundles, clearly identified in relation to bar lists.

2. PRODUCTS

2.1 Reinforcing Materials

.1 Reinforcing Steel: minimum 400 MPa yield grade; deformed billet steel bars conforming to CAN/CSA-G30.18; plain finish.

.2 Welded Steel Wire Fabric: plain type, conforming to ASTM A185; flat sheets; plain finish.

.3 Stainless Steel Bars: ASTM Type 316.

2.2 Accessory Materials

.1 Tie Wire: minimum 1.6 mm annealed type, or patented system accepted by Contract Administrator.

.2 Chairs, Bolsters, Bar Supports, Spacers: adequately sized for strength and support of reinforcing steel during construction.

.3 Bar Chairs for exposed surfaces: to be non-corrosive PVC chairs or concrete chairs purpose made. Steel bar chairs, galvanized bar chairs, concrete bricks, broken concrete blocks, or wood supports are not acceptable.

.4 Bar Chairs for non-exposed surfaces: broken concrete blocks, stones, and wood supports are not acceptable.

.5 Positioning Pins: smooth dowels, epoxy coated, sizes as indicated on Drawings.

3. EXECUTION

3.1 Fabrication

.1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1-00 and Drawings.

.2 Locate reinforcing splices not indicated on Drawings at points of minimum stress.

.3 Fabricate within the following tolerances:

.1 Sheared length: plus 0, minus 25 mm.

.2 Stirrups, ties, and spirals: plus 0, minus 10 mm.

.3 Other bends: plus 0, minus 25 mm.

.4 All bending shall be done cold with a suitable machine accurately producing all lengths, depths, and radii shown on the bending details.

.5 After initial fabrication, reinforcing steel shall not be rebent or straightened unless so indicated on the Drawings.

.6 Heating of reinforcing steel will not be permitted.

3.2 Installation

.1 Place reinforcing steel in accordance with reviewed placing Drawings and CAN/CSA-A23.1-00. Chair slab reinforcing not further apart than 1.2 m in either direction. Tie reinforcing steel at maximum spacing 600 mm.

.2 Adequately support reinforcing and secure against displacement within tolerances permitted.

.3 Place reinforcing steel to provide concrete cover required by CAN/CSA-A23.1-00, but not less than shown on Drawing Concrete Notes.

.4 Maintain alignment as follows:

.1 Slabs: ± 5 mm

.2 Other Structural Members: ± 10 mm

.3 Rebar Bends and Ends: ± 50 mm

.5 Do not disturb or damage polyethylene film or void form while placing reinforcing steel.

.6 Install purpose made highly visible protective safety caps on all exposed projecting bar ends to the satisfaction of the Contract Administrator.

.7 Accurately locate and secure positioning pins for precast concrete walkway panels as indicated on the Drawings using templates supplied by the precast supplier. Coordinate with the precast supplier for all requirements for placement of the positioning pins.

3.3 Cleaning

.1 Ensure concrete reinforcing is clean and free from oil and deleterious matter.

.2 Remove all loose scale, loose rust, concrete from prior pours, and other deleterious matter from surfaces of reinforcing prior to next adjacent concrete pour.

.3 Remove concrete splatter on bars before concrete has hardened.

END OF SECTION

CONCRETE ACCESSORIES

1. GENERAL

1.1 Work Included

.1 Joint Sealants.

.2 Expansive Waterstop.

.3 Joint Filler.

.4 Epoxy grout.

.5 Non-ferrous Grout.

.6 Latex Patching Agent.

.7 Epoxy Bonding Agent.

.8 Curing Compound.

.9 Moisture Retention Film.

.10 Fasteners.

2. PRODUCTS

2.1 General

.1 All materials shall be subject to the acceptance of the Contract Administrator.

2.2 Materials

.1 Joint Sealants:

.1 Sealants for all joints shall be non-sag two-part polysulphide to CAN/CGSB-19.24-M90, Thiokol 2235M by PolySpec or accepted alternate.

.2 Use compatible primer as per sealant Manufacturer's requirements.

.2 Expansive Waterstop: acceptable products are SikaSwell S Sealant by Sika and CS-231 Controlled Expansion Waterstop by ConSeal Concrete Sealants.

.3 Joint Filler: rigid closed cell foam, CPD PVC Closed Cell Joint Filler or accepted alternate.

.4 Epoxy grout: acceptable products are Sika Talygrout, CPD Epoxy Grout, or accepted alternate.

.5 Non-ferrous Grout: pre-mixed, non-shrink, Master Builders 713, Sika M-Bed, CPD Non-Shrink Grout, Steel C1 Grout, Grace In-Pakt Grout, minimum 35 MPa compressive strength.

.6 Latex Patching Agent: Acrl Stix, Daraweld-C Latex Bonding Agent, or accepted alternate.

.7 Epoxy Bonding Agent: Master Builders Concresive 1001 LPL, Dural Duralbond, Sikadur 32 HI-bond, or accepted alternate.

.8 Curing Compound: conforming to ASTM C309.

.9 Moisture Retention Film: Master Builders Confilm or accepted alternate.

.10 Fasteners: fasteners (all nuts, bolts, washers, screws, etc.) stainless steel for all aluminum items, conforming to ASTM 304 or 316, sizes and locations as required by item manufacturer.

2.3 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01300 – Submittals.

.2 Submit Manufacturer's product information for review for all materials to be incorporated into the Work.

3. EXECUTION

3.1 Installation

.1 Coordinate Work of this Section with other construction.

.2 Install all concrete accessories in accordance with Drawings and Manufacturer's recommendations and ensure compatibility. Install straight, level, and plumb.

.3 Ensure items are not disturbed during concrete placement.

.4 Curing and sealing compounds are to be used for curing purposes of all concrete where practical or compatible with finishes.

.5 Joint sealant shall be applied per Manufacturer's instructions. If joint surfaces are damp, dry the joint surfaces and apply primer as recommended by Manufacturer.

.6 Expansive Waterstop: apply to clean surfaces in uniform continuous beads per Manufacturer's instructions.

.7 Latex Patching Agent is to be used for patching formed concrete surfaces where required.

.8 Epoxy Bonding Agent is to be used to bond new concrete to existing concrete surfaces.

.9 Moisture retention film is to be used during hot windy weather conditions to prevent moisture loss immediately after concrete placement; apply per Manufacturer's instructions.

END OF SECTION

CAST-IN-PLACE CONCRETE

1. GENERAL

1.1 Work Included

.1 All reinforced cast-in-place concrete shown on the Drawings.

.2 Setting anchors, inserts, frames, sleeves, and other items supplied by other Sections.

.3 Repairing concrete imperfections.

.4 Finishing formed concrete surfaces.

.5 Curing of concrete.

1.2 Quality Assurance

.1 Cast-in-place concrete shall conform to the CAN/CSA-A23.1-00.

.2 Testing shall conform to CAN/CSA-A23.2-00.

.3 These standards shall be available in the Contractor's Site office for the use of the Contractor, sub-trades, and Contract Administrator.

.4 A Concrete Pour Release Form shall be completed prior to each concrete pour. The Contractor shall be responsible for completing the forms. Each form shall be signed by the Contractor and Contract Administrator prior to each pour.

1.3 Qualification

.1 Concrete flatwork finishing is to be done by an established firm having at least five (5) years of proven, satisfactory experience in this trade and employing skilled personnel.

.2 Submit proof of qualifications in writing to the Contract Administrator.

1.4 Inspection & Testing

.1 Notify the Contract Administrator at least forty eight (48) hours before complete formwork and concrete reinforcement is ready for review. Reinforcing in walls shall be reviewed prior to closing forms.

.2 Allow ample time for notification, review, and corrective Work, if required, before scheduling concrete placement.

.3 Concrete sampling, inspection, and testing is to be performed by a CSA certified inspection and testing firm appointed and paid for by the City.

.4 Provide unencumbered access to all portions of Work and cooperate with appointed firm.

.5 Submit proposed mix design of each class of concrete to the Contract Administrator for review two (2) weeks prior to commencement of the Work.

.6 Tests of cement and aggregates may be performed to ensure conformance with requirements stated herein.

.7 Notify the Contract Administrator at least twenty four (24) hours in advance of any concrete placement.

.8 At least three (3) concrete test cylinders will be taken for every seventy five (75) or less cubic metres of each class of concrete placed.

.9 At least three (3) test cylinders will be taken daily for each class of concrete placed.

.10 One (1) slump test and one (1) air content test will be taken for each set of test cylinders taken.

.11 Additional slump and air content tests may be taken as necessary (up to every truck) to verify quality of concrete at the discretion of the Contract Administrator.

.12 Testing of concrete will be performed in accordance with CAN/CSA-A23.2-00. Test results will be issued to the Contractor, the Contract Administrator, and the City.

.13 The Contractor shall pay costs for required retesting due to defective materials or workmanship.

.14 If accepted by the Contract Administrator, the Contractor may arrange and pay for additional tests for use as evidence to expedite construction.

.15 To conform to the strength requirements, the average of all tests shall exceed the specified strength. When three (3) or more tests of the same class of concrete are available, the average of any three (3) consecutive tests shall be equal to, or greater than the specified strength, and no strength test shall fall more than 3.5 MPa below the specified strength. If any of the criteria of the above clause are not met, the Contract Administrator shall have the right to require one or more of the following:

.1 Changes in mix proportions for the remainder of the Work.

.2 Cores drilled and tested from the areas in question as directed by the Contract Administrator and in accordance with CAN/CSA-A23.2-00. The test results shall be indicative of the strength of the in-place concrete.

.3 Load testing of the structural elements.

.4 The changes in the mix proportions, cores drilled and tested, and load testing shall be at the Contractor's expense.

.5 Concrete failing to meet the strength requirements of this Specification shall be strengthened or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator.

2. PRODUCTS

2.1 General

.1 All materials in concrete mixes shall be compatible.

2.2 Concrete Materials

.1 Cement: Normal Type 10 and Type 50 Portland Cement conforming to CSA-A3000.

.2 Fine Aggregate: conforming to Normal-Density Fine Aggregate, CAN/CSA-23.1-00. If requested by the Contract Administrator, submit evidence at least two (2) weeks before use in concrete mix showing conformance to Normal-Density Fine Aggregate, CAN/CSA-A23.1-00, Table 4 and Table 6.

.3 Coarse Aggregate: conforming to Normal-Density Coarse Aggregate, CAN/CSA-23.1-00, Group I, 40-5 mm, 20-5 mm, and 10 to 2.5 mm. If requested by the Contract Administrator, submit evidence at least two (2) weeks before use in concrete mix showing conformance to Normal-Density Coarse Aggregate, CAN/CSA-A23.1-00, Table 5 and Table 6. Group II may be used for special requirements such as gap grading, pumping, or for blending two (2) or more sizes to produce Group I gradings.

.4 Ensure that no aggregates are used that may undergo volume change due to alkali reactivity, moisture retention, or other causes. Confirm suitability of aggregate with a petrographic analysis if deemed necessary by the Contract Administrator.

.5 Water: potable, clean, and free from injurious amounts of oil, alkali, organic matter, or other deleterious matter.

.6 Materials are to be obtained from the same source of supply or Manufacturer for the duration of the project.

.7 Pozzolans: Type C fly ash, conforming to CAN/CSA-A3000, source of material to be acceptable to the Contract Administrator.

2.3 Admixtures

.1 No admixtures other than air-entraining agent, water-reducing agent, and superplasticizer shall be used without the written authorization of the Contract Administrator, unless specified.

.2 Air entrainment: conforming to ASTM Standard C260.

.3 Water-reducing agent: Type WN conforming to ASTM Standard C494.

.4 Superplacticizer: conforming to ASTM Standard C494.

.5 General Chemical Admixtures: conforming to ASTM Standard C494.

.6 Calcium chloride or admixtures containing calcium chloride shall not be used in concrete.

2.4 Accessories

.1 For accessories refer to Section 03250.

2.5 Concrete Mixes

.1 Pay all costs for mix design. Submit mix designs to the Contract Administrator for review a minimum of two (2) weeks prior to concrete pour.

.2 Provide concrete mixed in accordance with requirements of CAN/CSA-A23.1-00 and as indicated on the Drawings. The Drawing requirements shall govern where there is a difference between the Drawings and CAN/CSA-A23.1-00, Tables 6 to 10 requirements.

.3 Maximum allowable substitution of cement with fly ash material shall be 20% by weight when acceptable to the Contract Administrator.

.4 Use accelerating admixtures in cold weather only when accepted by the Contract Administrator. If accepted, the use of admixtures will not relax cold weather placement requirements. Do not use calcium chloride.

.5 Use set-retarding admixtures during hot weather only when accepted by the Contract Administrator.

.6 All materials and admixtures must be compatible within the mix. Concrete with freezing and thawing exposure must satisfy the durability requirements of CAN/CSA-A23.1-00, Sections 14 and 15.

.7 All admixtures are subject to acceptance by the Contract Administrator. List all proposed admixtures in mix design submission. Do not change or add admixtures to accepted design mixes without the Contract Administrator's review and acceptance.

.8 The water:cementitious material ratio must be calculated and shown based on all available mixing water excluding aggregate absorption.

.9 Concrete delivered to Site must be accompanied by a delivery slip indicating time of completion of mixing, design strength of concrete, air content, and actual water-cement ratio.

.10 Patching Mortar:

.1 The patching mortar shall be made of the same material and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than one (1) part cementitious material to two and a half (2.5) parts sand by damp loose volume.

.2 White Portland Cement shall be substituted for a part of the grey Portland Cement on exposed concrete in order to produce a colour matching the colour of the surrounding concrete, as determined by a trial patch.

.3 The quantity of mixing water shall be no more than necessary for handling or placing. Mixing water shall include one (1) part latex bonding agent to three (3) parts water. Maximum water:cementitious material ratio shall be 0.40.

.11 Self-compacting concrete mixes will not be permitted for use on this project.

3. EXECUTION

3.1 Placing Concrete

.1 Place concrete in accordance with requirements of CAN/CSA-A23.1-00 and as indicated on the Drawings. Layout of the Work and accuracy of same is the Contractor's sole responsibility.

.2 Notify the Contract Administrator a minimum of twenty four (24) hours prior to pouring concrete. Under no circumstances shall concrete be poured without notifying Contract Administrator, or in his absence, arranging for review of the Work and sampling of concrete.

.3 The concrete shall be placed rapidly and evenly as near to its final position as possible to reduce the risk of segregation, flowlines, and cold joints. Concrete shall be placed within one and a half (1.5) hours of mixing.

.4 Ensure all anchor bolts, seats, plates, and other items to be cast into concrete are securely placed and will not interfere with concrete placement.

.5 All equipment for transporting the concrete shall be cleaned of hardened concrete and foreign materials before placing concrete.

.6 Immediately before concrete is placed, Contractor shall carefully inspect all forms to ensure that they are properly placed, sufficiently rigid and tight, and that all reinforcing steel and embedded parts are in the correct position and secured against movement during the placing operation. All forms shall be thoroughly cleaned and material removed.

.7 Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods, which will prevent the separation or loss of the ingredients. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid re-handling or flowing. Vibrators shall not be used to move concrete. Under no circumstances shall the concrete, which has partially hardened, be deposited in the forms.

.8 Concrete shall be thoroughly compacted by mechanical vibrators during placing operations. Concrete shall be thoroughly worked around the reinforcement, embedded fixtures, and into the corners of the forms.

.9 Vibrate concrete using the appropriate size equipment as placing proceeds, in accordance with CAN/CSA-A23.1-00. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.

.10 Prepare set or existing concrete by removing all laitance and loose or unsound materials and apply bonding agent in accordance with Manufacturer's recommendations.

.11 Where placing operations would involve dropping the concrete more than 1500 mm, it shall be placed through canvas hoses or galvanized iron chutes. Concrete shall not be raised at a rate greater than that for which proper vibration may be affected.

.12 In locations where new concrete is dowelled to existing concrete, drill holes in existing concrete, insert steel dowels, and pack solidly with non-shrink grout.

.13 A minimum of three (3) days shall elapse between adjacent pours separated by construction joints or expansion joints.

.14 Do not place concrete if carbon dioxide producing equipment has been in operation in the building or in the enclosure during the twelve (12) hours preceding the pour. This equipment shall not be used during placing or for twenty four (24) hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or an impermeable membrane from direct exposure to carbon dioxide, combustion gases, or drying from heaters.

.15 Honeycomb or embedded debris is not acceptable.

.16 Remove and replace defective concrete.

.17 Maintain accurate records of cast-in-place concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.2 Cold Weather Concreting

.1 The requirements of this Section shall be applied to all concreting operations during cold weather, i.e., if the mean daily temperature falls below 5°C during placing or curing.

.2 Supplementary equipment as required below shall be at the job Site if concrete is likely to be placed in cold weather.

.3 Formwork and reinforcing steel shall be heated to at least 5°C before concrete is placed.

.4 The temperature of the concrete shall be maintained at not less than 10°C for seven (7) days. The concrete shall be kept above freezing temperature for at least a period of seven (7) days. In no case, shall the heating be removed until the concrete has reached a minimum compressive strength which will be specified by the Contract Administrator as determined from compressive strength tests on specimens cured under the same conditions as the concrete Works in question.

.5 Aggregates shall be heated to a temperature of not less that 20°C and not more than 65°C. Water shall be heated to a temperature between 55°C and 65°C. The temperature of the concrete at the time of placing in the forms shall be within the range specified in CAN/CSA-A23.1-00 for the thickness of the section being placed.

.6 When the mean daily temperature may fall below 5°C, a complete housing of the Work, complete with heaters, fuel, maintenance, and attendants shall be provided.

.7 Combustion-type heaters may be used if their exhaust gases are vented outside the enclosures and not allowed to come into contact with concrete surfaces. Fire extinguishers must be readily at hand wherever combustion-type heaters are used.

.8 When the ambient temperature is below -15°C, the housing shall be constructed so as to allow the concrete to be placed without the housing having to be opened. If the mixing is done outside of the housing, the concrete shall be placed by means of hoppers installed through the housing. The hoppers are to be plugged when not in use.

.9 When the ambient temperature is equal to or above -15°C, the Contractor will be permitted to open small portions of the housing for a limited time to facilitate the placing of the concrete.

.10 Before depositing any of the concrete, the Contractor shall show that enough heating equipment is available to keep the air temperature surrounding the forms within the specified range. This shall be accomplished by bringing the temperature inside of the housing to the specified 10°C at least twelve (12) hours prior to the start of the concrete placing.

.11 The Contractor shall supply all required heating apparatuses and the necessary fuel. When dry heat is used, a means of maintaining atmospheric moisture shall be provided.

.12 Sufficient standby heating equipment must be available to allow for any sudden drop in outside temperatures and any breakdowns which may occur in the equipment.

.13 The Contractor shall keep a curing record of each concrete pour. The curing record shall include date and location of the pour, mean daily temperature, temperatures above and below the concrete within the enclosures, temperatures of the concrete surface at several points, and notes regarding the type of heating, enclosure, unusual weather conditions, etc. This record shall be available for review by the Contract Administrator at all times, and shall be turned over to the Contract Administrator at the end of the concreting operations.

3.3 Hot Weather Concreting

.1 General

.1 The requirements of this Clause shall be applied during hot weather, i.e., air temperatures above 25°C during placing.

.2 Concrete shall be placed at as low a temperature as possible, preferably below 15°C, but not above 27°C. Aggregate stockpiles may be cooled by water sprays and sun shades.

.3 Ice may be substituted for a portion of the mixing water provided the ice has melted by the time mixing is completed.

.4 Forms and conveying equipment shall be kept as cool as possible before concreting by shading them from the sun, painting their surfaces white, and/or the use of water sprays.

.5 Sun shades and wind breaks shall be used as required during placing and finishing.

.6 Work shall be planned so that concrete can be placed as quickly as possible to avoid "cold joints".

.7 The Contract Administrator's acceptance is necessary before the Contractor may use admixtures such as retardants to delay setting, or water-reducing agents to maintain workability and strength, and these are to be included in the mix designs submitted to the Contract Administrator.

.8 Curing shall follow immediately after the finishing operation.

.2 Hot-Weather Curing

.1 When the air temperature is at or above 25°C, curing shall be accomplished by water or by using saturated absorptive fabric, in order to achieve cooling by evaporation. Mass concrete shall be water cured for the basic curing period when the air temperature is at or above 20°C, in order to minimize the temperature rise of the concrete.

.3 Job Preparation

.1 When the air temperature is at or above 25°C, or when there is the probability of its rising to 25°C during the placing period, facilities shall be provided for protection of the concrete in place from the effects of hot and/or drying weather conditions. Under severe drying conditions, as defined in Clause 3.4.5.2 of this Specification Section, the formwork, reinforcement, and concreting equipment shall be protected from the direct rays of the sun or cooled by fogging and evaporation.

.4 Concrete Temperature

.1 The temperature of the concrete as placed shall be as low as practicable and in no case greater than that shown below for the indicated size of the concrete section.

Thickness of Section (metres)	**Temperatures (°C)**	
	Minimum	**Maximum**
less than 0.3	10	27
0.3 – 1	10	27
1.2	5	25

.5 Protection from Drying

.1 Moderate Drying Conditions

.1 When surface moisture evaporation exceeds 0.75 kg/m^2/hr, windbreaks shall be erected around the sides of the structural element.

.2 Severe Drying Conditions

.1 When surface moisture evaporation exceeds 1.0 kg/m^2/hr, additional measures shall be taken to prevent rapid loss of moisture from the surface of the concrete. Such additional measures shall consist of the following:

.1 Erecting sunshades over the concrete during finishing and placing operations.

.2 Lowering the concrete temperature.

.3 Increasing humidity by applying fog spray immediately after placement and before finishing.

.4 Care shall be taken to prevent accumulation of water that may reduce the quality of the cement paste.

.5 Beginning the concrete curing immediately after trowelling.

.6 Application of moisture retention film.

.3 Surface Moisture Evaporation Rate

.1 The monograph, Figure D1, Appendix D of CAN/CSA-A23.1-00 shall be used to estimate surface moisture evaporation rates.

3.4 Concrete Protection for Reinforcement

.1 Ensure reinforcement is placed to provide minimum concrete cover in accordance with Section 03200.

3.5 Construction Tolerance

.1 The Work shall be carefully and accurately set out; true to the positioning, levels, slopes, and dimensions shown on the Drawings and conforming to Sections 03100 and 03200.

.1 Sizes of Member or Thickness of Slabs: +6 mm, - 0 mm.

.2 Cover of Concrete over Reinforcement: ±3 mm.

.3 Variations from Plumb: 6 mm in 3.0 m, 10 mm maximum.

.4 Variations from Flat: 3 mm in 3.0 m, 6 mm maximum.

.2 If these tolerances are exceeded the Contractor may, at the discretion of the Contract Administrator, be required to remove and replace or to modify the placed concrete before acceptance. The costs incurred by the Contract Administrator for such investigation, testing, or review of reconstruction and the cost of reconstruction shall be borne by the Contractor.

3.6 Finishing Slab Surfaces

.1 Finish all slab surfaces conforming to CAN/CSA-A23.1-00, Clause 22 and as specified below.

.2 Bull Floating

.1 Immediately after screeding, bull float floor surfaces to remove ridges and fill voids.

.2 Complete bull floating before any excess moisture or bleed water is visible on surface.

.3 Mechanical Floating

.1 Mechanical float floor surfaces when bleed water has disappeared and surfaces are sufficiently hard to prevent working excess mortar to surface.

.2 Continue floating as necessary to produce surfaces of uniform texture, free from hollows, bumps, and screed marks.

.3 For surfaces to be trowelled, continue floating as necessary to embed coarse aggregate particles firmly below surface mortar.

.4 Hand float in corners, restricted areas, and around cast-in items.

.4 Trowelling

.1 Trowel floor surfaces with mechanical trowelling machines fitted with steel blades.

.2 Commence trowelling when surfaces are sufficiently hard to prevent working excess fine material to surface.

.3 Perform additional trowelling at intervals so final trowelling is done just before concrete becomes so hard that further trowelling is ineffective.

.4 Finish trowelled surfaces to be hard, dense, and free from blemishes and other imperfections.

.5 Hand trowel in corners, restricted areas, and around cast-in items.

.6 Cure concrete as specified.

.7 Protect all floors from damage during construction.

3.7 Curing and Protection

.1 Cure and protect freshly placed concrete in accordance with Clause 21 of CAN/CSA-A23.1-00.

.2 All concrete shall receive moist curing for a period of at least seven (7) days. One (1) of the following methods shall be used as soon as the concrete has hardened sufficiently to prevent marring:

.1 Surface covered with canvas or other satisfactory material and kept thoroughly and continuously wet with soaker hoses.

.2 A liquid membrane forming curing sealer, applied at the rate recommended by the Manufacturer. Curing sealer shall not be used on a surface where bond is required for the finishes.

.3 Surfaces of concrete, which are protected by formwork that is left in place for seven (7) days, shall not require any additional curing (except as specified for hot weather). If the formwork is removed in less than seven (7) days, the concrete shall receive moist curing as above.

.3 No concreting will be allowed until all materials required for the curing phase are on Site and ready for use.

.4 At the end of the curing and protection period, the temperature of the concrete shall be reduced gradually at a rate not exceeding 10°C per day until the outside air temperature has been reached.

.5 Concrete that is allowed to freeze or attain insufficient curing conditions shall be subject to all necessary investigations and testing as deemed necessary by the Contract Administrator and all such concrete shall be removed and the portion reconstructed as directed by the Contract Administrator, at Contractor's cost.

.6 The supply (both quantity and time of supply) of water for curing concrete shall be subject to control of the City and prior arrangements shall be made by the Contractor with the City for its supply. The Contractor shall be responsible for, at his own cost, to supply, install, maintain, and move extensions to water services as required for conveying water to the work Site. Water required for curing concrete will be supplied by the City, from the Deacon Booster Pumping Station (DBPS).

3.8 Formed Concrete

.1 Allow the Contract Administrator to review concrete surfaces immediately upon removal of the forms.

.2 Modify or replace concrete not conforming to qualities, lines, details, and elevations specified herein or indicated on the Drawings to the acceptance of the Contract Administrator.

3.9 Finishing Formed Surfaces

.1 Interior formed concrete surfaces.

.1 Walls to be in contact with waste water to receive form liner finish as per Section 03100.

.2 Finish other surfaces exposed to view to Smooth-Form Finish conforming to CAN/CSA-A23.1-00, Clause 24.3.6.

.3 Finish non-exposed surfaces to Rough-Formed Finish conforming to CAN/CSA-A23.1-00, Clause 24.3.5.

.2 Exterior formed concrete surfaces.

.1 Finish surfaces to receive vapour barrier, insulation, waterproofing material, or roofing material to Smooth-Formed Finish conforming to CAN/CSA-A23.1-00, Clause 24.3.6.

.2 Finish other non-exposed surfaces to Rough-Formed Finish conforming to CAN/CSA-A23.1-00, Clause 24.3.5.

.3 Finish surfaces exposed to view to Smooth-Form Finish conforming to CAN/CSA-A23.1-00, Clause 24.3.6.

3.10 Equipment Pads, Pipe Supports, and Cast in Metal Frames

.1 Provide concrete pads and supports for equipment where and as indicated on Drawings. Adjust dimensions to reviewed equipment Shop Drawings.

.2 Insert bolts and sleeves and pack solidly with non-shrink grout, in accordance with setting details and templates.

.3 Steel trowel surface smooth. Chamfer exposed horizontal and vertical edges.

.4 Clean excess concrete from metal frames, inserts, weld plates, etc. Clean and tool concrete around the above noted items.

3.11 Grouting

.1 Grout all miscellaneous anchor bolts with non-ferrous or epoxy grout as specified using templates for accurate positioning.

.2 Grout under base plates and other items to provide continuous support over the entire contact area as required and shown on the Drawings.

3.12 Defective Concrete

.1 Concrete not meeting the requirements of the Specifications and Drawings will be considered defective concrete.

.2 Concrete not conforming to the lines, details, and grades specified herein or as shown on the Drawings shall be modified or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator. Finished lines, dimensions, and surfaces shall be correct and true within tolerances specified herein and in Section 03100.

.3 Concrete not properly placed resulting in honeycombing and other defects shall be repaired or replaced at the Contractor's expense and to the satisfaction of the Contract Administrator.

3.13 Patching

.1 Allow Contract Administrator to review concrete surfaces immediately upon removal of all formwork.

.2 Remove all exposed metal form ties, nails and wires, break off fins, and remove all loose concrete.

.3 Any imperfect joints, voids, stone pockets, or other defective areas and tie holes, as specified, shall at once be patched before the concrete is thoroughly dry. Defective areas shall be chipped away to a depth of not less than 40 mm with the edges perpendicular to the surface. The area to be patched and a space at least 150 mm wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar.

.4 Cure all patches thoroughly in accordance to Manufacturer's instructions.

3.14 Construction Joints

.1 Construction joint locations shall be as shown on the Drawings.

.2 Joints not indicated on the Drawings shall be located so as to least impair the strength of the structure. The location of these joints shall be subject to prior review and acceptance by the Contract Administrator. Joints shall be in accordance with CAN/CSA-A23.1-00, or as indicated on the Drawings.

.3 The surface of hardened concrete shall be thoroughly cleaned of foreign matter and laitance by sand blasting, and shall be thoroughly wetted with water, but not saturated, and the forms shall be re-tightened against the face of the hardened concrete before depositing additional concrete. Any concrete splatter on reinforcing bars shall be removed by sand blasting.

.4 For horizontal construction joints, the concrete shall be thoroughly compacted by hand trowel in and around the reinforcing bars.

3.15 Clean-Up

.1 As Work progresses and at the completion of Work, remove from Site all debris, excess materials, and equipment.

END OF SECTION

PRECAST CONCRETE WALKWAY PANELS

1. GENERAL

1.1 Work Included

.1 Solid Concrete Walkway Panel

.2 Bearing Pads

1.2 Design Requirements

.1 Design of precast concrete panels and connections to conform to CAN/CSA A23.4 and Canadian Prestressed Concrete Institute Design Handbook, under direct supervision of a Professional Engineer registered in the Province of Manitoba, fully experienced in the design of precast concrete structural units.

.2 Design all panels and connections to safely support their own weight, superimposed loads shown on Drawings, and all other forces and loads to which the structural panels may be subjected.

.3 Design connections to provide for structure movement.

1.3 Qualifications

.1 Manufacturer is to be certified for prestressed precast concrete products under CAN/CSA A251.

1.4 Quality Assurance

.1 Fabricate and install precast concrete panels in accordance with requirements of CAN/CSA A23.4.

.2 Maximum allowable manufacturing and erection tolerances are not to exceed those given in CAN/CSA A23.4.

1.5 Inspection and Testing

.1 Inspection and testing will be performed by a firm appointed and paid by the City at the discretion of the Contract Administrator. Notify Contract Administrator at commencement of shop work so inspection and testing may be scheduled.

.2 Provide free access to all portions of manufacturing plant and cooperate with appointed firm.

.3 If requested by Contract Administrator, submit proposed mix design for review prior to commencement of Work.

.4 Testing of cement and aggregates may be required to ensure conformance with requirements stated herein.

.5 Testing of concrete will be performed in accordance with CAN/CSA A23.4.

.6 If defects are revealed during testing of concrete and/or inspection of fabricated precast concrete panels, Contract Administrator will request additional testing and/or inspection to ascertain full degree of defects.

.7 Correct defects and/or irregularities to the satisfaction of the Contract Administrator. Further testing and/or inspection, under similar conditions as earlier, will be performed. The Contractor shall pay all costs for retesting and re-inspection.

.8 Test results will be issued to Contract Administrator.

1.6 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01300 – Submittals.

.2 Prepare Shop Drawings under the seal of a Professional Engineer registered in the Province of Manitoba.

.3 If requested by the Contract Administrator, submit for Contract Administrator's review, copies of design calculations for reinforcing, hoisting, and connection and anchorage devices.

.4 Clearly indicate product locations, fabrication details, unit identification marks, reinforcement, connection details, dimensions, erection support points, anchors and relationship to adjacent materials in sufficient detail to cover manufacture, handling and erection, indicate allowable design loads.

.5 Do not proceed with fabrication until Shop Drawings have been reviewed by the Contract Administrator.

1.7 Transportation/Handling/Storage

.1 Handle all precast panels in a position consistent with their shape and design. Do all lifting and supporting only from support points indicated on Shop Drawings.

.2 Embedded lifting or handling devices are to be capable of supporting panels in all positions anticipated during manufacture, storage, transportation and erection. Maintain capacity of lifting devices sufficient to resist forces of minimum 2.5 times weight of member.

.3 Deliver panels to Site completely finished. Clearly mark panels as indicated on Shop Drawings, with date of production and final position on structure.

.4 Block and laterally brace panels during transport and while stored on Site. Provide lateral bracing sufficient to prevent bowing and warping. Blocking and bracing to be clean, non-staining, and it shall not prevent uniform curing of exposed surfaces.

.5 Provide edges of panels with adequate protection to prevent staining, chipping, or spalling of concrete.

2. PRODUCTS

2.1 General

.1 Use forms and beds which are rigid, adequate to withstand prestressing forces and constructed of materials that will result in finished products conforming to requirements stated herein and on the Drawings.

.2 Establish concrete mix design by tests on trial batches to achieve required strengths. Maintain water content as constant as possible during manufacture.

.3 Provide concrete protection of reinforcement in accordance with CAN/CSA A23.4.

.4 Deposit and vibrate concrete to ensure proper consolidation, elimination of unintentional cold joints, and to minimize entrapped air on surfaces.

.5 Fabricate all required connecting devices, plates, angles, inserts, bolts, and accessories.

.6 Provide anchors and inserts to support loads as shown on the Drawings.

.7 Perform shop welding of connecting and supporting devices in accordance with requirements of CSA W59.

.8 Ensure anchors, inserts, plates, angles, and other cast-in items are accurately located. Maintain in position while concrete is placed and consolidated.

2.2 Finish

.1 Finish walkway panels to conform to requirements of CAN/CSA A23.4, Commercial Grade. Top surface to be finished with a medium broom finish.

2.3 Concrete Materials

.1 Cement: normal Portland cement: Type 10, conforming to CAN/CSA A3000.

.2 Fine and Coarse Aggregates: conforming to CAN/CSA A23.4, from a single source for each type of aggregate for entire job.

.3 Water: potable, free of deleterious matter that may interfere with finish, strength, and colour of concrete.

2.4 Reinforcement

.1 Reinforcing Steel: 400W MPa yield grade, deformed billet steel bars conforming to CSA G30.18.

.2 Reinforcing Wire: 480 MPa yield grade, deformed steel wire, conforming to CAN/CSA-G12.

.3 Welded Steel Wire Fabric: plain type.

.4 Prestressing Tendons: uncoated seven-wire, stress relieved strand, f_{pu}= 1860 MPa.

2.5 Hardware

.1 Connections, Supporting Devices: Type W Grade 300 steel, conforming to CSA G40.21, all galvanized to CAN/CSA-G164.

.2 Bolts, Nuts, and Washers: conforming to ASTM A325.

.3 Anchors, Inserts: patented, load-tested galvanized steel.

.4 Guardrail Anchor Plates: aluminum as supplied by Section 05530 – Aluminum Fabrications.

.5 Welding Materials: conforming to CAN/CSA-W48.

.6 Bearing Pads: neoprene pads with durometer 50.

2.6 Fabrication

.1 Maintain plant records and quality control program during the production of precast structural concrete, as required by CAN/CSA A251, Appendix D. Make records available to Contract Administrator upon request.

.2 Install PVC tubes for positioning pins as indicated on the Drawings.

.3 Place reinforcement between sides of panels and anchor bolts to be drilled and grouted for the guardrailing.

3. EXECUTION

3.1 Erection

.1 Provide temporary bracing for all stresses and induced loads during erection. Maintain temporary bracing in place until final support is provided.

.2 Provide all hoisting equipment and operate in accordance with all applicable safety regulations.

.3 Discontinue work and advise Contract Administrator when panels require adjustment beyond design criteria. Required modifications shall be performed at the Contractor's cost.

.4 Erect panels without damage to shape or finish. Replace or repair damaged panels to satisfaction of Contract Administrator, at the Contractor's cost.

.5 Erect all panels to be level, plumb, square, and true within allowable tolerances.

.6 Supply templates to reinforcing installer to accurately locate positioning pins.

.7 Install the neoprene bearing pads to dimensions and thickness indicated on the Drawings. Install precast panels over positioning pins and fill holes with asphaltic mastic as indicated on the Drawings.

.8 Perform welding of connecting and supporting devices in accordance with requirements of CSA W59.

.9 Prime paint field welds and touch up scratched and damaged galvanized surfaces.

END OF SECTION

ALUMINUM FABRICATIONS

1. GENERAL

1.1 Work Included

.1 Supply and installation of aluminum guard railings.

.2 Supply and installation of aluminum ladders complete with retractable pole.

.3 Supply and installation of aluminum access hatches complete with frame.

.4 Stainless steel anchors and bolts for bolted connections.

1.2 Standards

.1 Do aluminum Work to CSA S157.

.2 Welding to CSA W59.2.

.3 Company certification to CSA W47.2.

1.3 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01300 – Submittals.

.2 Shop Drawings to be sealed and signed by a Professional Engineer registered in the Province of Manitoba.

.3 Clearly indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

.4 Include erection drawings, elevations, and details where applicable.

.5 Indicated welded connections using CISC standard welding symbols. Clearly indicate net weld lengths.

2. PRODUCTS

2.1 Materials

.1 Aluminum: to CSA Standard HA, 6061-T6 or 6351-T6 Alloy unless specified otherwise.

.2 Nuts, bolts, and fastening devices connecting aluminum parts to aluminum, concrete, or other materials: stainless steel ASTM Type 316, with appropriate isolation devices.

.3 Isolation Coating: isolate aluminum from concrete by means of bituminous paint, single-component, alkali-resistant coal-tar pitch based; solvent clean surface preparation

(SP 1) with compatible cleaner, prime in accordance with Manufacturer's recommendations; apply two (2) coats minimum total 10 mills dry film thickness.

.4 Aluminum Grating: acceptable Manufacturer is Fisher & Ludlow Fisholoid Aluminum Grating, Type 30-102M, sizes as indicated on the Drawings.

.5 Retractable Aluminum Pole: acceptable product is Bilco Ladder Safety Post or accepted alternate.

2.2 General Fabrication

.1 Verify all dimensions on-site prior to fabrication.

.2 Connect bearing bars in a panel with a bar of same depth as bearing bars and minimum thickness of 5 mm.

.3 Finish openings requiring the cutting of four (4) or more bearing bars in the same manner as the end of the panel.

.4 Match position of bars and tie rods in adjacent panels to preserve a continuous appearance.

.5 Cover exposed aluminum surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating before shipping to Site. Leave protective covering in place until final cleaning of structures. Provide instruction for removal of protective covering.

3. EXECUTION

3.1 Examination

.1 Before starting erection, examine Work done under other Sections which may affect the Work.

.2 Notify the Contract Administrator of any conditions which would prejudice proper installation of the Work.

.3 Commencement of erection Work implies acceptance of existing conditions.

3.2 Erection

.1 Obtain the Contract Administrator's permission prior to Site cutting or making adjustments which are not part of the scheduled Work.

.2 Install items plumb, square and level; fit accurately, and maintain free from distortion or defects detrimental to appearance and performance.

.3 Make provisions for erection stresses and temporary bracing. Keep Work in alignment at all times.

.4 Replace items damaged in course of installation.

.5 Perform required field welding. Visible field welds to be smooth, grind as required.

.6 Perform necessary cutting and altering for the installation of Work of other Sections, and as indicated the Drawing. No additional cutting is to be done without the acceptance of the Contract Administrator.

.7 Perform all field assembly bolting and welding to match standard of shop bolting and welding. Bolts and screws are to be concealed whenever possible.

.8 Clip adjacent grating panels edges together at 1,500 mm spacing to prevent differential vertical movement.

.9 Provide two (2) hold-down clips at each end of the panels if not detailed on the Drawings.

.10 Provide anchors for setting in concrete with minimum 100 mm embedment.

.11 Paint aluminum surfaces in contact with concrete with two (2) coats of alkali-resistant bituminous paint.

.12 Prevent electrolysis between aluminum and dissimilar metals in contact with appropriate isolation devices.

END OF SECTION

RIGID WALL INSULATION

1. GENERAL

1.1 Work Included

.1 Perimeter foundation insulation.

.2 Waterproofing/Adhesive.

.3 Protection Board.

1.2 References

.1 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

.2 CAN/ULC-S701 - Thermal Insulation, Expanded, Extruded Polystyrene.

1.3 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01300 – Submittals.

.2 Submit Manufacturer's product information for review for all materials to be incorporated into the Work.

1.4 References

.1 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

.2 CAN/ULC-S701 - Thermal Insulation, Expanded, Extruded Polystyrene.

2. PRODUCTS

2.1 Materials

.1 Waterproofing/Adhesive: trowel grade fibrated rubberized waterproofing.

.2 Board Insulation: rigid insulation, CAN/ULC-S701, Type 4, extruded cellular polystyrene, square edges, Celfort by Celfortec; thickness as indicated on Drawings.

.3 Protection Board: fibreboard, minimum 12 mm thickness.

3. EXECUTION

3.1 Preparation

.1 Verify substrate and adjacent materials and insulation boards are dry and ready to receive insulation and adhesive.

.2 Verify substrate surface is flat, free of honeycomb, fins, irregularities and material that will impede adhesion of insulation.

.3 Verify insulation boards are unbroken, free of damage, with face membrane undamaged.

.4 Verify walls being insulated have been reviewed and accepted.

3.2 Board Insulation – Foundation Walls

.1 Install insulation vertically. Apply adhesive to Manufacturer's instructions.

.2 Butt edges and ends tight to adjacent board.

.3 Protect insulation with fibreboard during backfilling.

END OF SECTION

EQUIPMENT GENERAL PROVISIONS

1. GENERAL

1.1 Background

.1 The City of Winnipeg treats and supplies potable water to a population of approximately 632,000 people. The source of supply for the City of Winnipeg is surface water originating from Shoal Lake. The water is chlorinated at the intake and is conveyed via an Aqueduct to the Deacon reservoir, located just east of the City. The Deacon reservoir consists of four (4) open cells and holds approximately fourteen (14) to twenty eight (28) days supply for the City. Water is rechlorinated as it leaves the reservoir through two (2) branch Aqueducts. The Water Distribution System contains three (3) regional distribution reservoirs and pumping stations.

.2 The treatment process will be further enhanced by the construction of a filtration plant scheduled for completion in late 2007. The new filtration plant will consist of coagulation with ferric chloride, flocculation, clarification using DAF, ozonation, filtration, followed by disinfection using chlorine, UV light, and chloramination. The purpose of this tender document is to construct a dewatering cell and ancillary system for sludge dewatering.

1.2 Requirements

.1 The provisions of this Section shall apply to all equipment except where otherwise indicated.

.2 Substantiating calculations and Drawings shall be submitted at the time of submittal.

1.3 Reference Specifications, Codes, and Standards

.1 Equipment shall be in accordance with the latest edition of the following standards, as applicable and as indicated in each equipment Specification:

.1 ASTM

.2 ANSI

.3 ASME

.4 AWWA

.5 ASHRAE

.6 AWS

.7 NFPA

.8 FS

.9 NEMA

.10 Manufacturer's published recommendations and Specifications.

.11 General Industry Safety Orders (OSHA).

.12 CSA

.13 ULC

.2 The following standards are referenced in this Section:

.1 ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

.2 ANSI B16.5 - Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy and other Special Alloys.

.3 ANSI B46.1 - Surface Texture.

.4 ASME B1.20.1 - General Purpose Pipe Threads (Inch).

.5 ASME B31.1 - Power Piping.

.6 AWWA C206 - Field Welding of Steel Water Pipe.

.7 AWWA C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm through 3,600 mm).

.8 AWWA D100 - Welded Steel Tanks for Water Storage.

.9 ASTM A 48 - Gray Iron Castings.

.10 ASTM A 108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.

1.4 Contractor Submittals

.1 Shop Drawings: Furnish submittals in accordance with Section 01300 - Submittals.

.2 Equipment Installation: Complete all documentation as required within Section 01650 – Equipment Installation.

.3 Manuals: Provide manuals as specified within Section 01730 – Operation & Maintenance Manuals.

.4 Spare Parts List: A spare parts list complete with the name, address, and telephone number of the nearest distributor for each piece of equipment shall be provided. Include current prices for each spare part.

1.5 Quality Assurance

.1 Costs: Pay all costs of inspection, testing, adjustment, and instruction services performed by Manufacturer’s representatives. The City will pay for power and water.

.2 Quality and Tolerances: Tolerances and clearances shall be as shown on the Shop Drawings and shall be closely adhered to.

.1 Machine Work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts. Members without milled ends and which are to be framed to other steel parts of the structure may have a variation in the detailed length of not greater than 1.5 mm for members 10 m or less in length, and not greater than 3 mm for members over 10 m in length.

.2 Castings shall be homogeneous and free from non-metallic inclusions and defects. Surfaces of castings which are not machined shall be cleaned to remove foundry irregularities. Casting defects not exceeding 12.5% of the total thickness and where defects will not affect the strength and serviceability of the casting may be repaired by approved welding procedures.

.3 All materials shall meet the physical and mechanical properties in accordance with the reference standards.

.3 Machine Finish: The type of finish shall be the most suitable for the application and shall be shown in micro-inches in accordance with ANSI B46.1. The following finishes shall be used:

.1 Surface roughness not greater than 63 µin shall be required for all surfaces in sliding contact.

.2 Surface roughness not greater than 250 µin shall be required for surfaces in contact where a tight joint is not required.

.3 Rough finish not greater than 500 µin shall be required for other machined surfaces.

.4 Contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall be finished to not greater than 32 µin.

2. PRODUCTS

2.1 General Requirements

.1 Noise Level: When in operation, no single piece of equipment shall exceed the OSHA noise level requirement of 85 dBA for one (1) hour exposure per day.

.2 Drive Trains and Service Factors: Service factors shall be applied in the selection or design of mechanical power transmission components. All components of drive train assemblies between the prime mover and the driven equipment shall be designed and rated to deliver the maximum peak or starting torque, speed, and horsepower. All of the applicable service factors shall be considered, such as mechanical motors, load class, start frequency, ventilation, ambient temperature, and fan factors. Drive train components include couplings, shafts, gears and gear drives, drive chains, sprockets, and V-belt drives. Unless otherwise

indicated, a service factor of 1 and a uniform load classification for submersible pumps shall be used.

.3 Mechanical Service Factors

	Mechanical Service Factors
	Electric Motor
Uniform	1.25
Moderate Shock	1.50
Heavy Shock	2.00

.4 For thermal rating adjustments such as start frequency, ambient temperature, and hourly duty cycle factor, ventilation factor, and fan factor, refer to gear Manufacturer sizing information.

.5 Where load classifications are not indicated, service factors based on AGMA 514.02 shall be used for standard load classifications and service factors for flexible couplings.

.6 Welding: Unless otherwise indicated, welding shall conform to the following:

.1 Latest revision of AWWA D100.

.2 Latest revision of AWWA C206.

.3 Composite fabricated steel assemblies that are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.

.4 Welding shall be by the metal-arc method or gas-shielded arc method as described in the AWS "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards.

.5 In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. Sharp corners of material that is to be painted or coated shall be ground to a minimum of 0.8 mm ($^{1}/_{32}$-inch) on the flat.

.7 Protective Coating: Equipment shall be painted or coated as specified within each equipment Specification unless otherwise indicated. Non-ferrous metal and corrosion-resisting steel surfaces shall be coated with food grade grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

.8 Protection of Equipment: Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Equipment delivered to the Site with rust or corroded parts shall be rejected.

.9 Vibration Isolators: Air compressors, blowers, engines, inline fans shall be provided with restrained spring-type vibration isolators or pads per Manufacturer's written recommendations. Vibration isolations shall be provided with seismic restraint.

.10 Controls: Equipment and system controls shall be in accordance with Division 17 – Instrumentation.

2.2 Equipment Supports

.1 Equipment Supports: Unless otherwise indicated, equipment supports, anchors, and restrainers shall be adequately designed for static, dynamic, wind, and seismic loads. The design horizontal seismic force shall be the greater of: that noted in the general structural notes or as required by the governing building code, or 10% of gravity. Submitted design calculations for equipment supports shall bear the signature and seal of an engineer registered in Manitoba, unless otherwise indicated.

2.3 Couplings

.1 Mechanical couplings shall be provided between the driver and the driven equipment. Flexible couplings shall be provided between the driver and the driven equipment to accommodate slight angular misalignment, parallel misalignment, end float, and to cushion shock loads. Unless otherwise indicated or recommended by the Manufacturer, coupling type shall be furnished with the respective equipment as follows:

Equipment Type	Coupling Type
Direct or driven pumps	Gear or flexible spring

.2 Each coupling size shall be determined based on the rated horsepower of the motor, speed of the shaft, and the load classification service factor. The equipment Manufacturer shall select or recommend the size and type of coupling required to suit each specific application.

.3 Differential Settlement: Where differential settlement between the driver and the driven equipment may occur, two (2) sets of universal type couplings shall be provided.

.4 Taper-Lock or equal bushings may be used to provide for easy installation and removal of shafts of various diameters.

2.4 Shafting

.1 General: Shafting shall be continuous between bearings and shall be sized to transmit the power required. Keyways shall be accurately cut in line. Shafting shall not be turned down at the ends to accommodate bearings or sprockets whose bore is less than the diameter of the

shaft. Shafts shall rotate in the end bearings and shall be turned and polished, straight, and true.

.2 Design Criteria: All shafts shall be designed to carry the steady state and transient loads suitable for unlimited number of load applications, in accordance with ASME B106.1M, - Design of Transmission Shafting. Where shafts are subjected to fatigue stresses, such as frequent start and stop cycles, the mean stress shall be determined by using the modified Goodman Diagram. The maximum torsional stress shall not exceed the endurance limit of the shaft after application of the factor of safety of 2 in the endurance limit and the stress concentration factor of the fillets in the shaft and keyway. Stress concentration factor shall be in accordance with ASME Standard B17.1 - Keys and Keyseats.

.3 Materials: Shafting materials shall be appropriate for the type of service and torque transmitted. Environmental elements such as corrosive gases, moisture, and fluids shall be taken into consideration. Materials shall be as indicated unless furnished as part of an equipment assembly.

.1 Low carbon cold-rolled steel shafting shall conform to ASTM A108, Grade 1018.

.2 Medium carbon cold-rolled shafting shall conform to ASTM A108, Grade 1045.

.3 Other grades of carbon steel alloys shall be suitable for service and load.

.4 Corrosion-resistant shafting shall be stainless steel or Monel, whichever is most suitable for the intended service.

.4 Differential Settlement: Where differential settlement between the driver and the driven equipment may occur, a shaft of sufficient length with two (2) sets of universal type couplings shall be provided.

2.5 Sprockets

.1 General: Sprockets shall be used in conjunction with chain drives and chain-type material handling equipment.

.2 Materials: Unless otherwise indicated, materials shall be as follows:

.1 Sprockets with 25 teeth or less, normally used as a driver, shall be made of medium carbon steel in the 0.40 to 0.45% carbon range.

.2 Type A and B sprockets with 26 teeth or more, normally used as driven sprockets, shall be made of minimum 0.20% carbon steel.

.3 Large diameter sprockets with Type C hub shall be made of cast iron conforming to ASTM A48, Class 30.

.3 Sprockets shall be accurately machined to ANSI Standards. Sprockets shall have deep hardness penetration in tooth Sections.

.4 Finish bored sprockets shall be furnished complete with keyseat and set screws.

.5 To facilitate installation and disassembly, sprockets shall be of the split type or shall be furnished with Taper-Lock bushings as required.

.6 Idler sprockets shall be provided with brass or Babbitt bushings, complete with oil hole and axial or circumferential grooving with stainless steel tubing and grease fitting extended to an accessible location. Steel collars with set screws may be provided in both sides of the hub.

2.6 Bearings

.1 General: Bearings shall conform to the standards of the AFBMA.

.2 To assure satisfactory bearing application, fitting practice, mounting, lubrication, sealing, static rating, housing strength, and lubrication shall be considered in bearing selection.

.3 Re-lubricatable type bearings shall be equipped with hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

.4 Lubricated-for-life bearings shall be factory-lubricated with the Manufacturer's recommended grease to insure maximum bearing life and best performance.

.5 Anti-Friction Type Bearing Life: Except where otherwise indicated, bearings shall have a minimum L-10 life expectancy of five (5) years or 20,000 hours, whichever occurs first. Where so indicated, bearings shall have a minimum rated L-10 life expectancy corresponding to the type of service, as follows:

Type of Service	Design Life (years)	L-10 Design Life (hours)
	(whichever comes first)	
8 hour shift	10	20,000
16 hour shift	10	40,000
Continuous	10	60,000

.6 Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as indicated or as recommended in the published standards of the Manufacturer. Split-type housings may be used to facilitate installation, inspection, and disassembly.

.7 Sleeve Type Bearings: Sleeve-type bearings shall have a cast iron or ductile iron housing and Babbitt or bronze liner. Bearing housing shall be bolted and doweled to the lower casing half. These housings shall be provided with cast iron caps bolted in place and the bearing end caps shall be bored to receive the bearing shells. Sleeve bearings shall be designed on the basis of the maximum allowable load permitted by the bearing Manufacturer. If the sleeve bearing is connected to an equipment shaft with a coupling, the coupling transmitted thrust will be assumed to be the maximum motor or equipment thrust. Lubricant, lubrication system, and cooling system shall be as recommended by the bearing Manufacturer.

.8 Plate Thrust Bearings: Thrust bearings shall be the Kingsbury Type, designed and manufactured to maintain the shaft in the fixed axial position without undue heating or the necessity of adjustment or attention. Bearings shall be oil lubricated to suit the Manufacturer's standard method of lubrication for the specific bearing. If bearing cooling is required, the Manufacturer shall provide necessary piping, filters, and valves.

.9 Ensure adequate process stream protection from bearing lubricant leaks.

2.7 Piping Connections

.1 Pipe Hangers, Supports, and Guides: Pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment.

.2 Flanges and Pipe Threads: Flanges on equipment and appurtenances shall conform to ANSI B16.1, Class 125, or B16.5, Class 150, unless otherwise indicated. Pipe threads shall be in accordance with ANSI/ASME B1.20.1.

.3 Flexible Connectors: Flexible connectors shall be provided in all piping connections to engines, blowers, compressors, and other vibrating equipment and in piping systems. Flexible connectors shall be harnessed or otherwise anchored to prevent separation of the pipe where required by the installation.

.4 Insulating Connections: Insulating bushings, unions, couplings, or flanges, as appropriate, shall be used.

2.8 Gaskets and Packings

.1 Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron-type "V" packing shall be Garlock No. 432, John Crane "Everseal".

.2 Packing around rotating shafts (other than valve stems) shall be "O"-rings, stuffing boxes, or mechanical seals, as recommended by the Manufacturer.

2.9 Nameplates

.1 Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins. Nameplates shall contain the Manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.10 Tools and Spare Parts

.1 Tools: Furnish one (1) complete set of special wrenches and other special tools necessary for the assembly, adjustment, and dismantling of the equipment. Tools shall be of best quality hardened steel forgings with bright finish. Wrench heads shall have work faces dressed to fit nuts. Tools shall be suitable for professional Work and manufactured by Snap On, Crescent, Stanley, or equal. The set of tools shall be neatly mounted in a labelled toolbox of suitable design provided with a hinged cover.

.2 Spare parts shall be furnished as indicated in the individual equipment Sections. All spare parts shall be suitably packaged in a metal box and labelled with equipment numbers by means of stainless steel or solid plastic nametags attached to the box.

3. EXECUTION

3.1 Manufacturer's Representative Field Services

.1 Refer to Section 01650 – Equipment Installation.

.2 Arrange for a technically qualified Manufacturer's Representative to attend the installation work, certify correct installation, train operating and maintenance staff and undertake the testing of the system for sufficient periods, to ensure the equipment is installed, operated, and maintained in accordance with the Manufacturer's recommended procedures.

.3 The minimum periods of Site attendance are identified in the following table along with the form to be completed on each of these trips.

Equipment Type	Trip	Forms Required
Submersible Pump	Three	101, 102, 103, T1
TSS Monitor and Other Instruments	One	101, 102, 103, T1
Sluice Gates	Two	101, 102, 103, T1

.4 The total number of trips will depend on the Contractor's schedule. The cost of additional trips, to be determined by the Contract Administrator, will be borne by the Contractor. Arrange for a technically qualified Manufacturer's Representative to attend the installation Work, certify correct installation, train O&M staff and undertake the testing of the system for sufficient periods, to ensure the equipment is installed, operated, and maintained in accordance with the Manufacturer's recommended procedures.

3.2 Installation Witnessing

.1 The Contractor shall ensure that equipment is installed plumb, square and true within tolerances specified by the Manufacturer’s Representative and as indicated in the Contract Documents.

.2 The Manufacturer’s Representative shall ensure the equipment is installed as required to provide satisfactory service.

.3 The Manufacturer’s Representative and the Contractor are to cooperate to fulfill the requirements for a successful installation as documented by Form 102, illustrated in Section 01650 – Equipment Installation**.**

3.3 Equipment Performance Testing

.1 The Manufacturer's Representative shall ensure that each pump, valve, sluice gate, and instrument includes all component parts, and operate as intended.

.2 The Manufacturer's Representative shall demonstrate satisfaction of requirements specified herein.

.3 The Manufacturer's Representative and the Installation Contractor are to cooperate to fulfill the requirements for successful testing of the equipment as documented by Form 103, illustrated in Section 01650 – Equipment Installation.

END OF SECTION

SLUICE GATE

1. GENERAL

1.1 Work Included.

.1 Supply, delivery to the Site, installation, training, testing, and performance verification support of stainless steel 316 sluice gates to be installed in the new City of Winnipeg WTP dewatering cells.

.2 Provide Shop Drawings of the equipment in accordance with Section 01300.

.3 Fabricate and factory test the equipment, shop assemble, and inspect sluice gates to ensure that field fitting shall not be required.

.4 Provide O&M Manuals.

.5 Produce Record Drawings.

.6 Provide technical support and remedy defects during the warranty period.

.7 All deliveries are to be in accordance with the Project Master Schedule.

.8 Where no specifications are provided for an item, AWWA C561-04 applies.

1.2 Metric Units

.1 While it is intended that this specification be written in consistent metric units, it is recognized that:

.1 Manufacturer's standard equipment may not be available in the units specified.

The following Imperial to Metric conversions shall be used where applicable:

1 in = 25.4 mm	1 lb = 0.45350 kg
1 ft = 0.30480 m	1 gal. Imp. = 4.5461 L
1 lb = 4.448 N	1 gal. US = 3.7854 L
1 lb ft = 1.3558 N m (torque)	1 ft^3 = 28.317 L
1 lb ft^2 = 0.04214 kg m^2 (inertia)	1 hp = 0.746 kW

2. SUBMITTALS

2.1 Shop Drawings:

.1 Refer to Section 01300 – Submittals.

.2 Shop Drawings shall show performance data for equipment. For each gate provide:

.1 Frame assembly details.

.2 Concrete embedment and attachment details.

.3 Installation instructions.

.4 Thimble dimensions.

.5 Operator details.

.6 Stem details.

.7 Seal details.

.3 The Shop Drawings shall show exactly the location of all anchor bolts, brackets, supports, pipe connections, etc., that must be installed by the Contractor.

2.2 Operation and Maintenance Manuals

.1 To be in accordance with Section 01730 – Operation and Maintenance Manuals.

3. PERFORMANCE

.1 The sluice gates shall be designed to withstand the design head specified in the Sluice Gate Schedule as specified herein.

.2 Sluice gates shall be substantially watertight under the design head conditions. Allowable leakage shall be as per AWWA C561-04.

.3 All sluice gates shall be suitably designed for a continuous immersion in ferric chloride sludge.

4. ACCEPTABLE MANUFACTURERS

4.1 Stainless Steel Sluice Gate

.1 H. Fontaine Ltd.

.2 Waterman Industries Inc.

.3 Hydro Gate Company

.4 Or approved equal

5. PRODUCTS

5.1 General

.1 Provide new material only.

.2 Confirm with Contract Administrator all elevations prior to manufacturing.

.3 The stainless steel gate frame shall be constructed of structural members or formed plate welded to form a rigid one-piece frame.

.4 Where applicable, the frame shall be flange back and suitable for mounting on a wall thimble.

.5 The frame configuration shall allow the replacement of the top and side seals without removing the gate frame from the wall thimble.

.6 The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to $^{1}/_{720}$ of the gate's span under the design head.

.7 The gate guide liner shall be made of "True" UHMWPE and shall be of such length as to retain and support at least two thirds of the vertical height of the slide in the fully open position.

.8 Side and top seals shall be made of "True" UHMWPE of the self-adjusting type. A continuous compression cord shall ensure contact between the UHMWPE guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the slide and allow the water to flow only below the slide plate.

.9 The flush bottom seal shall be set and mechanically fastened into the bottom member of the frame.

.10 Provide all actuator mounting hardware and accessories mounted on the device prior to shipment.

.11 Provide device and actuator as a matched set from the same Manufacturer wherever possible.

.12 Tag the control devices and accessories to indicate operating characteristics.

5.2 Lift Assemblies

.1 The operating stem shall be of stainless steel and designed to transmit in compression at least two (2) times the rated output of the operating manual mechanism with a 178 N effort on the crank or handwheel.

.2 The stem shall have a slenderness ratio (Length/Radius) of less than two hundred (200). The threaded portion of the stem shall have machine cut threads of the Acme type.

.3 For stems in more than one piece and with a diameter of 45 mm and larger, the different sections shall be joined together by solid couplings. The couplings shall be threaded and keyed or threaded and bolted and shall be of greater strength than the stem. Stems with a diameter smaller than 45 mm shall be pinned to an extension tube.

.4 Stem guides shall be adjustable and spaced in accordance with the Manufacturer's recommendation. The Length/Radius ratio shall not be greater than 200.

.5 Rising stem gates shall be provided with a clear stem cover. The stem cover shall have a cap and condensation vents, and a clear Mylar position indicating tape. The tape shall be field applied to the stem cover after the gate has been installed and positioned.

5.3 Lifting Mechanism

.1 General

.1 Operators of the types listed under item 6 shall be provided by the Contractor. Each manual operator shall be designed to operate the gate under the maximum specified seating and unseating heads by using a maximum effort of 178 N on the crank or handwheel, and shall be able to withstand, without damage, an effort of 356 N.

.2 Gearboxes shall be provided when required to maintain the operating force below 178 N. All bearings and gears shall be totally enclosed in a weather tight housing. The pinion shaft of crank-operated mechanisms shall be constructed of stainless steel and supported by roller or needle bearings. The operating shaft shall be fitted with a 50 mm square operating nut and removable crank. The crank shall be fitted with a corrosion-resistant rotating handle. The maximum crank radius shall be 380 mm and the maximum handwheel diameter shall be 600 mm.

5.4 Materials

.1 Stainless Steel Gates shall be as per the following:

Part	Material
Frame	Stainless steel ASTM A-240 316L
Slide	Stainless steel ASTM A-240 316L
Guides	Stainless steel ASTM A-240 316L
Stem Guides	Stainless steel ASTM A-240 316L
Threaded stem	Stainless steel ASTM A-276, Type 316
Seats	UHMWPE, ASTM D-4020-96
Stem Guide Bushings	Stainless Steel ASTM A276 316
Anchor Bolts and Fasteners	Stainless Steel ASTM F593 or F594 GR2 316
Wedges and Pressure pads	Stainless Steel ASTM A276 316 or ASTM A743
Gate Operator Lift Nut	Bronze ASTM B584 or ASTM B505
Operator and lift	Enclosed gear lift with pedestal suitable for operating with an electric portable drill and manual opening.
Stem Couplings	Stainless steel ASTM A-276 316
Stem cover	Galvanized steel pipe with acrylic window with graduations
Thrust Nuts	Stainless Steel ASTM A276, 316
Pedestal	SS 316 Stainless Steel
Gears	Steel AISI 8620, 4140, or 1117
Gear Housing	Stainless Steel ASTM A276 316, or ASTM A312, or ASTM A376
Flush Bottom Sill	Extruded or molded neoprene
Flush Bottom Sill Retainer	Stainless Steel ASTM A276 316

6. EXECUTION

6.1 Surface Treatment and Finishes

.1 Surface Treatment and Finishes

.1 Carbon and alloyed steel surfaces require coatings. Stainless steel does not require coatings.

.2 Stainless steel to be cleaned to such that all surfaces are free of dirt and grease.

.3 All surfaces requiring coatings to be cleaned to NACE SSPC-SP6.

.4 Prior to application of coatings, submerged surfaces shall be prepared to NACE SSPC-SP10- Near-White Metal Blast Cleaning. Non submerged surfaces shall be prepared to SSPC SP.

.5 Submerged 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.

.6 Submerged surfaces shall comply with ANSI/NSF 61” Drinking Water System Components – Health Effects”.

.7 Submerged or surfaces subjected to splashing require two (2) or more layers (5 mils minimum each coat) of Polyamide Epoxy, Amerlock 400, Tnemec Series 140F Pota-Pox Plus or approved equal. Application as per Manufacturer's recommendations.

.8 Above ground surfaces require one (1) layer (5 mils minimum) of a high solids epoxy coating. Coating is required to be suitable for potable water application.

.9 Coatings shall be holiday free as defined in Section 5.1 of AWWA Standard C550.

.10 After coated surfaces are dry, a protective grease shall be applied to all machined or bearing surfaces and holes to prevent corrosion prior to installation.

6.2 Performance Testing

.1 Performance testing shall be conducted as per Section 01650-Equipment Installation.

.2 Supply and install steel box complete with gasket and anchor system to simulate water submerged condition testing for each sluice gate. Designed box shall be water tight and capable of holding designed pressure.

.3 Provide tap connection for pressurizing the gate to the designed pressures of the sluice gate. Provide suitable gauge to measure the test pressure.

.4 Any re-testing until each gate passes the water tightness test shall be at the Contractor's cost.

7. SLUICE GATE SCHEDULE

7.1 Gate Schedule for Area L (Dewatering Cells)

<table>
<tr><td>Specification Standard:</td><td>AWWA C561-04 for Fabricated Stainless Steel Slide Gates</td></tr>
<tr><td>Nominal Size:</td><td>600 W mm x 1200 H mm(SLG-L150A)
600 W mm x 1200 H mm (SLG-L250A)
600 W mm x 1200 H mm (SLG-L350A)
600 W mm x 1200 H mm (SLG-L450A)</td></tr>
<tr><td>Type:</td><td>
<table>
<tr><th>Gate No.</th><th>Type*</th><th>Opening</th><th>Material of Construction</th></tr>
<tr><td>SLG-L150A</td><td>Wall Mount, Rising Stem</td><td>Downward</td><td>Stainless Steel 316</td></tr>
<tr><td>SLG-L250A</td><td>Wall Mount, Rising Stem</td><td>Downward</td><td>Stainless Steel 316</td></tr>
<tr><td>SLG-L350A</td><td>Wall Mount, Rising Stem</td><td>Downward</td><td>Stainless Steel 316</td></tr>
<tr><td>SLG-L450A</td><td>Wall Mount, Rising Stem</td><td>Downward</td><td>Stainless Steel 316</td></tr>
</table>
* Provide water seal on all four sides of the gates.
</td></tr>
</table>

SLUICE GATE

Mounting Details:

Gate No.	Opening Invert Elevation (m)	Top of Roof Slab Elevation (m)	Top of Opening Elevation (m)	Max. Water Level (m)
SLG-L150A	239.29	241.70	240.49	240.5
SLG-L250A	239.33	241.70	240.53	240.5
SLG-L350A	239.35	241.70	240.55	240.5
SLG-L450A	239.28	241.70	240.48	240.5

Confirm with Contract Administrator all Elevations Prior to Manufacturing

Seating and Unseating Head:

Gate No.	Unseating Head (m)	Seating Head (m)
SLG-L150A	2	2
SLG-L250A	2	2
SLG-L350A	2	2
SLG-L450A	2	2

Wall Thickness:

Gate No.	Wall Thickness (mm)
SLG-L150A	350 mm
SLG-L250A	350 mm
SLG-L350A	350 mm
SLG-L450A	350 mm

Operator:

Gate No.	Operator Type	Motor and Operating Conditions
SLG-L150A	Geared Manual Crank / Handwheel	NA
SLG-L250A	Geared Manual Crank / Handwheel	NA
SLG-L350A	Geared Manual Crank / Handwheel	NA
SLG-L450A	Geared Manual Crank / Handwheel	NA

Stem Cover: Galvanized steel pipe with acrylic window c/w graduations in millimetres

Position Monitoring: Not Required

END OF SECTION

FIELD-APPLIED CORROSION PROTECTION AND MAINTENANCE COATINGS

1. GENERAL

.1 Provide, apply, and maintain the specified field applied protective and maintenance coating systems. Coatings are required on all process and mechanical equipment, vessels and pipes unless specifically deleted.

.2 Refer to Drawings and Schedules for the type, location and extent of coatings required and include for all field coating necessary to complete all the work shown, specified or scheduled.

1.2 Delivery and Storage

.1 Deliver all coating materials to the site in sealed containers properly labelled to indicate the Manufacturer's name, type and colour of contents, date of manufacture, batch number, and storage requirements.

.2 Provide adequately heated and ventilated storage for all materials and ensure compliance with fire prevention regulations.

2. PRODUCTS

2.1 Manufacturers

.1 All constituents of each coating system are to be provided by the same Manufacturer.

.2 Acceptable Manufacturers: Valspar, Sherwin Williams, Benjamin Moore

2.2 Schedule of Surface Treatments

.1 The Schedule of Surface Treatments defines the components of the protective coating system.

Schedule of Surface Treatments

Ref.	Description	Surface Treatments
A	Solvent Cleaning	As SSPC-SP1
B	Hand Tool Cleaning	As SSPC-SP2
C	Power Tool Cleaning	As SSPC-SP3
D	Brush Blast	As SSPC-SP7
E	Near White Metal Blast	As SSPC-SP10
F	White Metal Blast	As SSPC-SP5 (NACE #1)
G	Abrasion	The surface shall be lightly abraded using steel wool or abrasive cloth to provide a key for the next coat, to remove runs or excessive brush marks.
H	Vinyl Wash Primer	DFT 13 microns. To be over-coated within 24 hours

Ref.	Description	Surface Treatments
I	Zinc Chromate Primer	Nominal DFT 40 microns
J	Inorganic Zinc Primer	Zinc in ethyl silicate vehicle. Minimum DFT 40 microns
K	Industrial Enamel (to 100ºC)	To 1-GP-61M Alkyd Enamel. Minimum DFT 30 microns
L	High Built Epoxy	To AWWA C210 and certified by an appropriate testing agency (NSF Std. 61, CSA, etc.) for use on waste water applications. Minimum DFT 200 microns
M	Bituminous Paint	To AWWA C230, MIL-P-151470
N	Silicone Alkyd (100ºC to 150ºC)	Min. 60% solids by weight. Nominal DFT 40 microns
O	Silicone Enamel (150ºC to 400ºC)	To 1-GP-143M, DFT 40 microns
P	Fast Drying Aluminum Sealer	To 1-GP-69M, Nominal DFT 25 microns
Q	Canvas Insulation Sealer	Acrylic or PVA latex
R	Epoxy Gloss Enamel	To 1-GP-146, nominal DFT 50 microns

SSPC: Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, PA 15213
Surface Preparation Specifications, March 1985.

2.3 Schedule of Protective Systems

.1 The schedule of protective systems defines the combination of surface treatments required in each system and the sections of the plant to which it is to be applied. The systems have been grouped into three (3) categories as follows:

.1 Category A: Immersed Service, equipment or material fully, partially or intermittently immersed in water during routine plant operation.

.2 Category B: Exposed Service, equipment or material exposed to the normal range of atmospheric conditions and conditions common to water treatment facilities (high humidity, etc.)

.3 Category C: Indoor Service, equipment or materials inside buildings or other ventilated spaces.

2.4 Category A

.1 Category A: All Category A systems will be tested by the Contract Administrator using a wet sponge holiday detector set at 67.5 V. Touch up will be required at points where the detector is grounded.

.2 Schedule:

Schedule of Systems

System	Surface Treatments	Typical Applications
A1	A, D, L, L	Equipment or piping delivered with inorganic zinc primer, e.g. clarifier mechanics, mixers, etc.
A2	A, F, J, L, L	Equipment or piping delivered uncoated or with coatings not compatible with epoxy, e.g. ductile iron, cast iron or steel pipe and pipe sleeves inside treatment units. External Surfaces at valves, fabricated pipe supports, brackets, etc.
A3	A, G, M	Aluminum surfaces in contact with concrete, e.g. access cover frames
A4	A, E	Ferrous metal surface cast into concrete, e.g. penstocks, pipe sleeves
A5	A	Stainless steels, plastics, and fibreglass products

2.5 Category B

.1 Schedule:

Schedule of Systems

System	Surface Treatments	Typical Applications
B1	A, B, R, R	Equipment or piping delivered with inorganic zinc primer, e.g. motors, flocculator gearbox & motor, valve headstocks, piping above ground & outside treatment units, hydrants, etc.
B2	A, B, J, R, R	Equipment or piping delivered but not applied with an inorganic zinc prime coat or with a prime coat not compatible with an inorganic zinc overcoat.
B3	A, B, H, R, R	Galvanized or cadmium plated goods, e.g. pipe supports or brackets, mountings for electrical or control equipment (Unistrut, etc.)
B4	A	Stainless steel or aluminum products, e.g. insulation recovering

2.6 Category C

.1 Schedule

Schedule of Systems

System	Surface Treatments	Typical Applications
C1	A, B, K, K	Equipment or piping delivered c/w factory finished coatings. Coated for system identification and maintenance. Surface temperature during operation not exceeding 100ºC, e.g. pumps, air handling units, valves, etc.
C2	A, G, K, K	Equipment or accessories fully primed. Surface temperatures not exceeding 100ºC, e.g. pumps, steel piping
C3	A, C, I, N, N	Equipment or accessories as C1 or C2 but with operating surface temperatures between 100ºC and 150ºC, e.g. air compressors, blowers
C4	E, J, O	Equipment or accessories as C1 or C2 but with operating surface temperatures between 150ºC and 400ºC, e.g. boiler fittings
C5	B, P, K, K	Piping or valves with bituminous or tar coatings. Surface temperatures not exceeding 100ºC, e.g. cast iron & ductile iron pipe, valves.
C6	A, K, K	PVC pipe, fittings or accessories coated for identification only.
C7	A, H, K, K	Aluminum insulation recovering coated for identification only.
C8	A, Q, G, N, N	Canvas insulation recovering.

NOTE: (1) Surface preparation G-abrasion has not been fully scheduled but is to be carried out between all coatings.
(2) No bare ferrous metal surfaces are permitted. Pipe hanger rods etc., unless zinc or cadmium plated, are to be at least prime coated. Cut ends of plated surfaces (Uni-strut, etc.) are to be spot primed.

2.7 Colour Coding

.1 Coordinate with the Contract Administrator for pipe and equipment identification colour coding.

3. EXECUTION

3.1 Quality Assurance

.1 Apply all paints and coatings strictly in accordance with the Manufacturer's directions.

.2 Pay particular attention to ensure the compatibility of each surface treatment with the preceding and subsequent surface treatments and coatings. Ensure the compatibility of all surface treatments and coatings.

3.2 Environmental Conditions

.1 Do not apply a coating when the ambient or surface temperature is below 10°C or less than 3°C above the dew point.

.2 Provide adequate ventilation and sufficient heating to maintain temperatures above 7°C for twenty four (24) hours before coatings are applied. Continue heating to maintain 10ºC during application and for forty eight (48) hours after application.

.3 Provide a minimum of 300 lux illumination on surface to be treated.

.4 Do not apply coatings where dust is being generated.

3.3 Protection

.1 Provide sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted. Make good any damage resulting from inadequate or unsuitable protection.

.2 Maintain all coated surfaces until completion of the works. Damage to coatings, occurring at any time, shall be made good within seven (7) days.

.3 Place cotton waste, cloths and material which may constitute a fire hazard in closed metal containers and remove from the Site at suitable intervals.

.4 Remove and, after painting, replace or adequately mask all grease nipples, bright metal surfaces, identification plates and other items not to be painted. Do not use solvent that may remove permanent lacquer finishes.

3.4 Condition of Surfaces

.1 Thoroughly examine all surfaces to be treated or coated prior to commencement of Work. Report, in writing, to the Contract Administrator any condition or defect that may affect the integrity or quality of the finished coating. Do not commence Work on any section until all such defects in that section have been corrected.

.2 On all factory primed or coated equipment, touch up defects prior to the application of subsequent coatings.

.3 Be responsible for the condition of surfaces and for correcting defects and deficiencies in the surface.

END OF SECTION

FACTORY APPLIED MAINTENANCE AND CORROSION PROTECTION COATINGS

1. GENERAL

1.1 Work Included

.1 Supply and application of all factory applied prime coats or factory applied finish coats.

1.2 Submissions

.1 With the equipment Shop Drawings, submit details of the coating systems to be applied.

1.3 Quality Assurance

.1 This Specification is intended to be a minimum reference standard. The Contractor may submit for review alternative coating systems for specific items of equipment which provide equal or better corrosion protection and maintenance service than those specified herein.

2. PRODUCTS

2.1 Surface Preparation

.1 Immersion Service: After degreasing, dry blast all ferrous components to a white metal finish in accordance with SSPC-SP5 to a degree of cleanliness in accordance with NACE No. 1 and obtain a 50 µm blast profile.

.2 Non-immersion Service: After degreasing, dry blast all ferrous components to a near white finish in accordance with SSPC-SP10 to a degree of cleanness in accordance with NACE No. 3 and obtain a 50 µm blast profile.

2.2 Prime Coating

.1 Prime coat all ferrous surfaces before the blasted surfaces deteriorate.

.2 Coat ferrous surfaces with inorganic zinc primer, containing a minimum of 50% solids by volume, applied to a minimum dry film thickness of 75 µm.

.3 Coating method shall be governed by the coating Manufacturer's recommendation and to the requirement of SSPC 6000 Painting Practices.

2.3 Assembly

.1 For items which are to be bolted together before shipment, clean surfaces and coat before the parts are assembled.

.2 Continuous weld all welded connections, sealing the mating surface completely. On completion of the welding and fettling, treat all weld seams with phosphoric acid solution. Rinse and thoroughly dry before the prime is applied.

.3 Where dissimilar metals are mated insulate the mating surfaces from one another to provide protection against corrosion. Insulate bolts, nuts, washers, and rivets in a similar manner.

.4 Use 304 stainless steel or better for all nuts, bolts, washers and similar fittings for immersion service. For non-immersion service, use 304 stainless or zinc or cadmium plated nuts, bolts, washers, and similar fittings. Clean and coat the inner face of non-threaded bolt holes as required for other surfaces.

2.4 Schedule of Surface Treatments

.1 The schedule of Surface Treatments defines the components of the protective coating systems.

Schedule of Surface Treatments

Ref.	Description	Surface Treatments
A	Solvent Cleaning	As SSPC-SP1
B	Hand Tool Cleaning	As SSPC-SP2
C	Power Tool Cleaning	As SSPC-SP3
D	Brush Blast	As SSPC-SP7
E	Near White Metal Blast	As SSPC-SP10
F	White Metal Blast	As SSPC-SP5 (NACE #1)
G	Abrasion	The surface shall be lightly abraded using steel wool or abrasive cloth to provide a key for the next coat, to remove runs or excessive brush marks.
H	Vinyl Wash Primer	DFT 13 µ. To be over-coated within 24 hours
I	Water Borne Acrylic Primer	Nominal DFT 40 µ
J	Inorganic Zinc Primer	Zinc in ethyl silicate vehicle. Minimum DFT 40 µ
K	Industrial Enamel (to 100ºC)	To CAN/CGSB 1.161 Exterior and Interior Marine Alkyd Enamel. Minimum DFT 30 µ
L	High Built Epoxy	To AWWA C210, certified by appropriate testing agency (NSF STD 61-CSA, etc.). For use on potable water application.
M	Bituminous Paint	To AWWA C230, MIL-P-151470
N	Silicone Alkyd (100ºC to 150ºC)	Min. 60% solids by weight.
O	Silicone Enamel (150ºC to 400ºC)	To CAN/CGSB 1.143, DFT 40 µ
P	Fast Drying Aluminum Sealer	To CAN/CGSB 1.69, Nominal DFT 25 µ
Q	Canvas Insulation Sealer	Acrylic or PVA latex
R	Epoxy Gloss Enamel	To CAN/CGSB 1.146, Nominal DFT 50 µ

SSPC: Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, PA 15213
Surface Preparation Specifications, March 1985.

2.5 Schedule of Protective Systems

.1 The schedule of protective systems defines the combination of surface treatments required in each system and the sections of the plant to which it is to be applied. The systems have been grouped into three categories as follows:

.1 Category A: Immersed Service - equipment or material fully, partially or intermittently immersed in water (chlorinated) during routine plant operation.

.2 Category B: Exposed Service - equipment or material exposed to the normal range of atmospheric conditions and conditions common to water treatment and storage (high humidity, etc.)

.3 Category C: Indoor Service - equipment or material inside buildings or other ventilated spaces.

2.6 Category A

.1 Category A: All category A systems will be tested by the Contract Administrator using a wet sponge holiday detector set at 67.5 V. Touch up will be required at points where the detector is grounded.

.2 Schedule

Schedule of Systems

System	Surface Treatments	Typical Applications
A1	A, D, L, L	Equipment or piping delivered with inorganic zinc primer
A2	A, F, J, L, L	Equipment or piping delivered uncoated or with coatings not compatible with epoxy, e.g. ductile iron, cast iron or steel pipe and pipe sleeves inside treatment units. External Surfaces at valves, fabricated pipe supports, brackets, etc.
A3	A, G, M	Aluminum surfaces in contact with concrete, e.g. access cover frames
A4	A, E	Ferrous metal surface cast into concrete, e.g. penstocks, pipe sleeves
A5	A	Stainless steels, plastics, and fibreglass products
A6	A,E,J,M,M	Ferrous metal immersed in abrasive environment

2.7 Category B

.1 Schedule

Schedule of Systems

System	Surface Treatments	Typical Applications
B1	A, B, R, R	Equipment or piping delivered with inorganic zinc primer, e.g. clarifier motor, gearbox & motor, valve headstocks, piping above ground & outside treatment units, hydrants, etc.
B2	A, B, J, R, R	Equipment or piping delivered but not supplied with an inorganic zinc prime coat or with a prime coat not compatible with an inorganic zinc overcoat.
B3	A, G, R, R	Equipment delivered with factory applied paint which is to be painted for identification only.
B4	A	Stainless steel or aluminum products, e.g. insulation recovering

2.8 Category C

.1 Schedule

Schedule of Systems

System	Surface Treatments	Typical Applications
C1	A, B, K, K	Equipment or piping delivered c/w factory finished coatings. Coated for system identification and maintenance. Surface temperature during operation not exceeding 100ºC, e.g. pumps, air handling units, valves, etc.
C2	A, G, K, K	Equipment or accessories fully primed. Surface temperatures not exceeding 100ºC, e.g. pumps, steel piping
C3	A, C, I, N, N	Equipment or accessories as C1 or C2 but with operating surface temperatures between 100ºC and 150ºC, e.g. air compressors, blowers
C4	E, J, O	Equipment or accessories as C1 or C2 but with operating surface temperatures between 150ºC and 400ºC, e.g. boiler fittings
C5	B, P, K, K	Piping or valves with bituminous or tar coatings. Surface temperatures not exceeding 100ºC, e.g. cast iron & ductile iron pipe, valves.
C6	A, K, K	PVC pipe, fittings or accessories coated for identification only.
C7	A, H, K, K	Aluminum insulation recovering coated for identification only.
C8	A, Q, G, N, N	Canvas insulation recovering.

NOTE: (1) Surface preparation G-abrasion has not been fully scheduled but is to be carried out between all coatings.

(2) No bare ferrous metal surfaces are permitted. Pipe hanger rods etc., unless zinc or cadmium plated, are to be at least prime coated. Cut ends of plated surfaces (Uni-strut, etc.) are to be spot primed.

2.9 Colour Coding

.1 Refer to Section 11910 – Identification for pipe and equipment identification colour coding.

2.10 Acceptable Products

.1 General Paints Canada Ltd.

.2 ICI Paints Canada Ltd.

.3 Amercoat Ltd.

.4 Rust Oleum

.5 Valspar

.6 Carboline

.7 Plasite

3. EXECUTION

3.1 Inspection

.1 Notify the Contract Administrator two (2) weeks before commencing the protective coating to permit the inspection by the Contract Administrator of the surface preparation and protective coating application.

3.2 Protection

.1 Protect all coated equipment adequately against damage, dust, moisture, and scratching during shipment, off-loading and storage On-Site. If, in the opinion of the Contract Administrator, the coating is damaged during shipment to the extent that touch up would not be satisfactory, return and re-coat the equipment at the Contractor's cost.

.2 Make good damage to coatings occurring at any time prior to the application of any further coatings.

3.3 Application Conditions

.1 Apply all factory applied coatings under controlled conditions, in a dust-free atmosphere at a temperature of between 10 and 20°C, and a relative humidity should not exceed 80%.

END OF SECTION

IDENTIFICATION

1. GENERAL

1.1 Work Included

.1 Identification of equipment, motors, vessels, valves, ferrous, non-ferrous and insulated piping.

2. PRODUCTS

2.1 Equipment Nameplates

.1 Provide metal nameplate on each piece of Manufacturer's equipment, mechanically fastened with raised or recessed letters.

.2 Provide ULC and/or CSA registration plates, as required by respective agency.

.3 Manufacturer's nameplates to indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.2 Piping

.1 All piping installed under this Contract shall be painted and identified with pipe markers designating the pipe service and the direction of flow, except for stainless steel pipe and aluminum recovered pipe which shall be banded and identified.

.2 Pipe markers shall either be painted on the pipe or be self adhesive stick-on decals.

.3 Direction arrows are to be 150 mm long x 70 mm wide for piping with an outer diameter 75 mm or larger, including insulation. Use 100 mm long x 20 mm high for smaller diameters. Abbreviations for names of the pipe service are provided in the Drawings.

2.3 Colour Coding

.1 Colour coded system identification shall be carried out on the following items:

.1 All uninsulated piping and valves.

.2 All canvas and cotton insulated coverings.

.3 All pumps - coat pumps with the colour identifying the material being pumped.

.4 Paint all motors grey.

.2 Identification shall consist of the following:

.1 Full coating of non-stainless steel pipes and valves to the colour designated for the medium being conveyed.

.2 Coat non-submerged process equipment to match the colour requirements of the material being processed.

.3 Paint valve handles, chain wheels, and similar appurtenances black.

.3 Identification colours shall be as shown in accordance with standard colour and identification schedules. The Contract Administrator will provide details of the colours to be used within seven (7) days of such requests by the Contractor.

3. EXECUTION

3.1 Equipment Manufacturer's Nameplates

.1 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

3.2 Equipment Project Identification

.1 Attach plates to the equipment with sheet metal screws or nuts and bolts (adhesive will not be accepted).

.2 Fasten plates in conspicuous locations. Where plates cannot be mounted on hot or cold surfaces, provide standoffs.

3.3 Piping

.1 On completion of protective coatings or finish painting, neatly stencil on yellow, green, or white backgrounds, as appropriate, direction flow arrows and the pipe service or attach pipe marking labels.

.2 Provide pipe identification in readily visible locations. Piping shall be identified:

.1 At each valve.

.2 On both sides of wall penetrations.

.3 At floor and roof penetrations

.4 On each leg of branches.

.5 Every 10 m along continuous runs.

END OF SECTION

ELECTRICAL GENERAL REQUIREMENTS

1. GENERAL

1.1 Work Included

.1 Supply and installation of 600V interlocked receptacles and four conductor #10 Teck cables and electrical conduit embeds as required by the Drawings and as herein specified.

1.2 Drawings and Specifications

.1 The General Conditions, Supplementary Conditions, and Division 1 are a part of this Specification and apply to this Division.

.2 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.

.3 Symbols used to represent various electrical devices often occupy more space on the Drawing than the actual device does when installed. In such instances, do not scale locations of devices from electrical symbols. Install these devices with primary regard for usage of wall space, convenience of operation and grouping of devices.

.4 Consider these Specifications and the Drawings and Specifications of all other Divisions as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications, or the Drawings, but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.5 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the Work.

.6 If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting tender.

.7 Responsibility to determine which Division provides various products and work rests with the Contractor. Additional compensation will not be considered because of differences in interpretation of specifications.

1.3 Quality Assurances

.1 Codes, Rules, Permits and Fees

.1 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this work.

.2 Comply with all rules of the Canadian Electrical Code, CSA Standard C22.1 and the applicable building codes. Do Underground Systems in accordance with CAN/CSA-C22.3 No. 7 except where specified otherwise.

.3 Quality of Work specified and/or shown on the Drawings shall not be reduced by the foregoing requirements.

.4 Give all required notices, submit Drawings, obtain all permits, licenses and certificates and pay all fees required for this Work.

.5 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

.2 Standard of Workmanship:

.1 Execute all Work in a competent manner and to present an acceptable appearance when completed.

.2 Employ a competent supervisor and a sufficient number of licensed tradesmen to complete the Work in the required time.

.3 Arrange and install products to fit properly into designated building spaces.

.4 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of Manufacturers.

1.4 Submittals

.1 See Section 01300 – Submittals.

1.5 Record Drawings

.1 Refer to Division 1.

1.6 Operation and Maintenance Manuals

.1 Refer to Section 01730 – Operation and Maintenance Manuals

1.7 Product Handling

.1 Use all means necessary to protect the products of this Division before, during and after installation and to protect products and installed work of all other trades.

.2 Immediately make good any damage by repair or replacement at no additional cost to the City and to the approval of the Contract Administrator.

.3 Remove advertising labels from all electrical equipment. Do not remove identification or certification labels.

.4 Remove dirt, rubbish, grease, etc. resulting from this Work from all surfaces, including the inside of all cabinets, equipment enclosures, panelboard tubs, etc.

2. PRODUCTS

2.1 Quality of Products

.1 All products provided shall be CSA Approved, ULC approved where applicable, unless otherwise specified.

.2 If products specified are not CSA approved, obtain special approval from the local regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Products provided, if not specified, shall be new, of a quality best suited to the purpose required and their use subject to approval by the Contract Administrator.

2.2 Uniformity of Manufacture

.1 Unless otherwise specifically called for in the Specifications, uniformity of manufacture for similar products throughout the Work.

2.3 Product Finishes

.1 Finish all cabinets, panelboards, switchboards, equipment cabinets, MCCs, etc. in ANSI 61 grey enamel unless otherwise specified.

.2 Apply primer on all items, which are to be finished on the job.

.3 Touch up all damaged painted finishes with matching lacquer, or, if required by the Contract Administrator, completely repaint damaged surface.

2.4 Use of Products during Construction

.1 Any equipment used for temporary or construction purposes shall be approved by the Contract Administrator and in accordance with the General Conditions, "USE OF PREMISES". Clean and restore to "as new" condition all equipment prior to the time of substantial completion.

3. EXECUTION

3.1 Site Examination

.1 Examine the Site of Work and become familiar with all features and characteristics affecting this Work before submitting tender.

.2 No additional compensation will be given for extra work due to existing conditions, which such examination should have disclosed.

.3 Report to the Contract Administrator any unsatisfactory conditions, which may adversely affect the proper completion of this Work.

3.2 Coordination with Other Divisions

.1 Examine the Drawings and Specifications of all Divisions and become fully familiar with their Work. Before commencing Work, obtain a ruling from the Contract Administrator if any conflict exists, otherwise no additional compensation will be made for any necessary adjustments.

.2 Lay out the Work and equipment with due regard to architectural, structural, process and mechanical features. Architectural and structural Drawings take precedence over electrical Drawings regarding locations of walls, doors and equipment.

.3 Do not cut structural members without approval of the Contract Administrator.

.4 Coordinate with all Divisions installing equipment and services, and ensure that there are no conflicts.

.5 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.

.6 Examine previously constructed work and notify the Contract Administrator of any conditions, which prejudice the proper completion of this Work. Commencement of this Work without such notification constitute acceptance of other work.

3.3 Location of Outlets and Luminaires

.1 Electrical Drawings are, unless otherwise indicated, drawn to scale and approximate distances and dimensions may be obtained by scaling. Figured dimensions govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural Drawings.

.2 Outlet and equipment locations shown on the Drawings are approximate. Locations may be revised up to 3 m to suit construction and equipment arrangements without additional cost to the City, provided that the Contractor is notified prior to the installation of the outlets, or equipment.

.3 Maintain luminaire locations wherever possible. Notify the Contract Administrator of conflicts with other services.

.4 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of Manufacturers.

3.4 Separation of Services

.1 Maintain separation between electrical wiring system and building piping, ductwork, etc. so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.

.2 In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.

.3 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Contract Administrator and the ceiling installer, and approved clips or hangers are used.

3.5 Equipment Identification

.1 3 mm thick plastic lamicoid name plates, black face, white core, mechanically attached with self tapping screws, 6 mm high lettering, to be attached to the front face of the following equipment:

NAMEPLATE SIZES

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

.1 Distribution Centres (Indicate designation, bus capacity, voltage)

.2 MCCs (designation, voltage)

.3 Starters, contactors, disconnects (designation, voltage, load controlled)

.4 Panelboard (designation, voltage, bus capacity)

.5 Automatic transfer switch (designation, voltage, rating)

.6 Terminal cabinets and pull boxes (system, voltage)

.7 Transformers (designation, capacity, primary and secondary voltage)

.2 Color code exposed conduits (including conduits above T-bar ceilings), junction and pull boxes, and metallic sheathed cables with paint or plastic tape (25 mm wide band) at 15 m intervals. Color coding to be as follows:

SYSTEM	MAJOR BAND	MAJOR BAND
347/600 V Normal	Dk. Blue	
120/208 V Normal	Lt. Blue	
UPS System	Lt. Blue	White
Fire Alarm System	Red	
Telephone	Lt. Green	
Building Alarm	Pink	
Intercom Systems	Purple	Green
Security Systems	Dk. Green	Lt. Brown
Door Intercom/Video	Purple	Yellow

.3 Provide neatly typed circuit directories in panelboards to indicate the area or equipment controlled by each branch circuit.

.4 Identify all conductors by coloured insulation and permanent markers at every terminal and accessible points throughout its entire run, as per the Canadian Electrical Code.

.5 Conductors:

.1 Equipment Grounding – Green

.2 Neutral Conductor – White

Fire Alarm System	
Neutrals	White
Switch Legs	Phase Colour with White Tracer
Speaker Cct.	Blue with Yellow Tracer
Box Circuit	Black with Yellow Tracer
Annunciator	Brown with Yellow Tracer

.6 Place cable metal identification markers bearing the equipment tag number on all Teck cables on both ends and all locations where the cable leaves the cable tray or penetrates a concrete wall

.7 Install red plastic warning tape, 300 mm below grade, above all underground ducts.

.8 Provide permanent, corrosion resistant warning markers, suitable to the local inspection authority, imbedded in the surface of concrete slabs, which are directly above high voltage cables and duct banks.

3.6 Wiring to Equipment Supplied by Others

.1 Equipment supplied by the City or under other Division will be moved to the installation Site by others. However, the electrical connection to the equipment shall be done by this Division.

3.7 Testing

.1 Refer to Section 16980 – Testing, Adjusting and Balancing of Electrical Equipment and Systems.

3.8 Access Panels

.1 Where electrical equipment, junction boxes, remote ballasts or the like are concealed, supply access panels. Use panels of adequate size for servicing of the electrical Work and complete with necessary frames and hinged doors held closed with captive fasteners. Coordinate type and size of panels with the Contract Administrator.

.2 In removable ceiling areas, provide markers on ceiling tile to locate equipment requiring access. Use markers of a type approved by the Contract Administrator.

3.9 Mounting Heights

.1 Unless a conflict exists, use the following as mounting heights from finished floors to centre of device.

Receptacles in Mechanical Rooms and Process Areas	1000 mm
Receptacles and Telephone Outlets in offices and control rooms	300 mm
Light Switches	1400 mm
Fire Alarm Manual Stations	1400 mm
Fire Alarm Bells	2100 mm
Clocks	2100 mm
Television and Computer Outlets	300 mm
Intercom	1400 mm
Thermostats	1400 mm
Door Entry Push-Buttons	1400 mm
Wall-mounted speakers	2100 mm
Panelboards, starters, and disconnects (to top of cover)	2000 mm
End of Line Resistors	1800 mm
Outlets above Counters	175 mm above countertop or backsplash

3.10 Sealing of Wall and Floor Openings

.1 Seal all conduit and cable entries through outside walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade to prevent passage of moisture, dust, gasses, flame, or to maintain pressurization.

.2 Seal openings when all wiring entries shown on the Drawings have been completed.

.3 Sealing material fire resistant and not containing any compounds, which will chemically affect the wiring jacket or insulating material. Seal cable penetrations through fire separations.

3.11 Housekeeping Pads

.1 Mount all floor mounted electrical equipment installed by this Division on concrete housekeeping pads, which, unless otherwise noted, shall be the responsibility of this Division.

.2 Determine the extent of the housekeeping pads required and supply all information and details as to size and locations to the Contract Administrator within thirty (30) days after the Contract Notice to Proceed.

3.12 Sleeves

.1 Provide sleeves of galvanized steel pipe with machine cut ends of ample size to accommodate conduits passing through walls, partitions, ceilings, floors, etc.

.2 For wall, partitions and ceilings ensure the ends are flush with the finish on both sides, but for floors extend 100 mm above finished floor level.

.3 Fire stop opening with ULC approved assembly for the installation conditions. Mount lamacoid indicating assembly requirements by penetration. Include assembly details in O&M Manuals.

.4 Locate and position sleeves exactly prior to construction of walls, floors.

.5 Failure to comply with the above requirements shall be remedied at this Division's expense.

3.13 Temporary Lighting and Power

.1 Provide grounded extension cords and temporary lights required for electrical Work.

.2 Coordinate with Contractor for obtaining temporary power service.

.3 If City operations will be affected by any power outage required for this work, give adequate notice to the City and do not interrupt power until approval has been obtained.

.4 Give adequate notice to other Divisions of any power outage required for this Work. Schedule outages to provide least interference with other Work.

END OF SECTION

INSTALLATION OF CABLES IN TRENCHES AND IN DUCTS

1. GENERAL (NOT USED)

2. PRODUCTS

2.1 Markers

.1 Concrete type cable markers: [600 x 600 x 100] mm with words: "cable", "joint" or "conduit" impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

3. EXECUTION

3.1 Direct Burial of Cables

.1 After sand bed specified in Division 2 is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Make termination and splice only as indicated leaving 0.6 m of surplus cable in each direction.

.1 Make splices and terminations in accordance with Manufacturer's instructions using approved splicing kits.

.4 Underground cable splices not acceptable.

.5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with Manufacturer's instructions.

.6 Maintain 75 mm minimum separation between cables of different circuits. Maintain 300 mm horizontal separation between low and high voltage cables. When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position. At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables. Maintain 300 mm minimum lateral and vertical separation for fire alarm and control, cables when crossing other cables, with fire alarm and control cables in upper position. Install treated planks on lower cables 0.6 m in each direction at crossings.

3.2 Cable Installation in Ducts

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables properly terminated, seal ends of lead covered cable with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.3 Field Quality Control

.1 Perform tests in accordance with Section 16980 – Testing, Adjusting and Balancing of Electrical Equipment and Systems.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance test for cables under 1000 V.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Pre-acceptance test for cables over 1000 V.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 5000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.7 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.8 Acceptance Tests for cables over 1000 V

.1 High Potential (Hipot) Testing.

.1 Conduct Hipot testing at 200% of original factory test voltage in accordance with Manufacturer's or IPCEA recommendations.

.2 Leakage Current Testing.

.1 Raise voltage in steps from zero to maximum values as specified by IPCEA Manufacturer for type of cable being tested.

.2 Hold maximum voltage for specified time period by IPCEA or Manufacturer.

.3 Record leakage current at each step.

.9 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test.

.10 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

1. GENERAL

1.1 Work Included

.1 Provide a complete system of conduit and fittings for installation of wiring.

2. PRODUCTS

2.1 Rigid Steel Conduit

.1 Galvanized with threaded joints and connections.

.2 Connections in dry locations: steel or malleable iron locknuts inside and outside enclosures. Insulated bushings Thomas & Betts Series 222.

.3 Connectors subjected to moisture interior and exterior: liquid and dust tight with insulated throat, Thomas & Betts "Bullet Hub" 370 Series.

.4 Fittings: cast metal "Condulet" as manufactured by Crouse-Hinds Canada Ltd. including gasketted covers in damp locations.

.5 Expansion joints: cast metal Crouse-Hinds type XJ or approved alternate.

2.2 EMT Conduit

.1 Conduit: galvanized electrical metallic tubing.

.2 Fittings: steel rain-tite connectors with insulated throat. Steel rain tite couplings.

2.3 Rigid PVC Conduit

.1 Conduit: rigid non-metallic conduit of unplasticized PVC as manufactured C.G.E. "Sceptre" Schedule 40.

.2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit Manufacturer.

.3 Solvent: as recommended by conduit Manufacturer.

.4 Use rigid steel epoxy coated elbows where exiting the slab

2.4 Flexible Conduit (Open Air)

.1 Conduit: spiral wound, interlocking flexible metal conduit.

.2 Connectors: slip-proof, insulated throat or non-metallic bushings, steel, Thomas & Betts Ltd. "Tite-Bite", Series 300.

2.5 Flexible Conduit (Embedded in Slab)

.1 Plastic conduit ENT may be used in the slab

.2 For conduit slab exit, use rigid steel, epoxy coated elbows

2.6 Liquid-Tight Flexible Conduit

.1 Conduit: flexible metal conduit with liquid-tight PVC jacket. Industrial Wire & Cable "Liquiseal".

.2 Connectors: captive sealing jacket and ground cone insulated throat, steel (Thomas & Betts Ltd. "Super-Tight", Series 6000).

2.7 Rigid Aluminum Conduit

.1 Conduit: rigid extruded aluminum with threaded joints and connections and interior silicone coating to meet requirements of CSA C22.2 No. 45. Rigid metal conduit.

.2 Fittings: copper free cast aluminum conduit fittings for indoor and outdoor installations.

3. EXECUTION

3.1 Rigid Steel Conduit

.1 Use as raceways for following applications:

.1 In all areas exposed to weather.

.2 Locations where mechanical damage may occur and in mechanical rooms to a height of 1 m.

.3 Three phase motor wiring (Teck cable may also be used for this application where shown on the Drawings).

.4 In hazardous classified areas.

3.2 EM.T Conduit

.1 Use as raceways for following applications:

.1 For housing digital communications cables.

.2 In dry finished areas such as offices, and control rooms.

.2 It may not be used in any other areas.

3.3 Rigid PVC Conduit

.1 Use as raceways for following applications

.1 In poured concrete floors and walls and on underground runs exterior to the buildings unless otherwise noted.

.2 Wiring installed in areas subject to intermittent or continuous moisture but not surface mounted.

.3 Category 2 locations.

.4 Do not surface mount rigid PVC conduit.

.2 Use strictly in accordance with the Canadian Electrical Code. Do not use in return air plenums and for exit and fire escape lights.

.3 Provide insulated ground wire in all rigid PVC conduits in accordance with the Canadian Electrical Code.

.4 Where rigid PVC conduit is set in poured concrete, solvent joints must be completed and allowed to set as per manufacturer's instructions. Tie PVC conduit securely to prevent movement and broken joints from concrete pour and vibration.

.5 Bend rigid conduit in strict accordance with Manufacturer's directions. Distorted bends will not be accepted.

3.4 Flexible Conduit

.1 Use as raceways for following applications:

.1 Connections to fhp motors in dry locations.

.2 Flexible connections to luminaries, in dry areas such as offices, control rooms and similar finished locations.

.2 Provide a separate insulated ground wire in all flexible conduits.

3.5 Liquid-Tight Flexible Conduit

.1 Use as raceways for following applications:

.1 At all motors, pipe mounted control devices, luminaries in non classified plant process areas, and other devices subject to movement or vibration in non classified process areas.

.2 At all motors provide a short length before connecting to the motor terminal box. Minimum length shall be 450 mm plus 4 times the conduit diameter.

.3 Provide a separate ground wire within flexible conduit, bonded to motor frames and system ground.

3.6 Aluminum Conduit

.1 Use as a raceway for the following applications and as indicated on Drawings.

.1 In wet areas for surface conduit runs.

.2 Surface mounted in tank areas and exterior.

.2 Follow Manufacturer's recommendations for cutting, threading, reaming and bending.

.3 Use thread compound to prevent thread damage and ensure watertight connections. Do not use red or white lead paint.

.4 Do not install in poured concrete.

3.7 Workmanship

.1 Install all conduit and wiring concealed, unless otherwise shown on the Drawings. Do not recess conduit in columns, except as noted, without permission from the Contract Administrator.

.2 Where conduit is run exposed, run parallel to building lines. Where conduits are grouped (two or more), space evenly, make bends concentric and mount on Unistrut racks.

.3 Lay out conduit to avoid interference with other work. Maintain a minimum clearance of 150 mm from steam or hot water piping, vents, etc.

.4 Slabs on grade: Install rigid PVC conduit in the gravel base below concrete slabs. Transition to rigid steel conduit around stub-ups through slab and extend 150 mm beyond concrete. When rigid steel conduit is installed in contact with earth, protect using Polykin #940 tape. Extend taping 300 mm above finished grade.

.5 Metal conduit installations in concrete pours: Tie down conduit to prevent shifting. Make all joints tight to ensure ground continuity. To prevent concrete entry, pack outlet boxes and cap conduit terminations both in boxes and stub-ups. Apply Polykin #940 tape to the conduit 152 mm both sides of the point of leaving slab.

.6 Do not place conduit in concrete slabs in which slab thickness is less than four times conduit diameter. Place conduits larger than this size under floor. Conduits to have minimum 25 mm concrete cover, or as shown.

.7 Organize conduit in slabs to minimize crossovers. Obtain approval and minimum concrete cover required as per Division 3 prior to installing conduits in slabs.

.8 At all recessed panels cap 2 to 25 mm and 4 to 19 mm empty conduits from panel into ceiling above and below for future use.

.9 Where conduit is installed in floor slabs to run up at equipment or motors, carefully check all conduit locations. Verify conduit locations for mechanical equipment from Shop Drawings or detail Drawings. Brace all stub-ups. For stub-ups, use rigid steel.

.10 Where steel conduit is required to be bent, do not heat, and do not bend conduit in such a way as to reduce pipe cross section area at any point. Radii of bends shall be as per Canadian Electrical Code.

.11 For all runs of conduits, do not include more than equivalent of 4 - quarter bends. Provide conduit fittings, pullboxes and junction boxes where necessary. Do not use pulling elbows, except by special permission.

.12 Where possible, install conduits so that they are not trapped, cap turned up conduits to prevent the entrance of dirt of moisture during construction. Swab out conduit and thoroughly clean internally before wires and cables are pulled.

.13 Take extreme care in reaming ends of all conduit to ensure a smooth interior finish that will not damage the insulation of the wires.

.14 Use insulated non-metallic bushings on all conduit terminations.

.15 Ensure electrical continuity in all conduit systems.

.16 All conduit shown exposed in finished areas is to be free of unnecessary labels and trade marks.

.17 Install a 44 kg test line in all conduits left empty, including those in which others will pull cables, wires, etc.

.18 For conduits and ducts crossing building expansion joints, provide conduit expansion fittings to suit the type of conduit used, and shall be Crouse-Hinds, Sceptre, or approved fitting.

.19 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with Dow Corning 3-6548 sealant. Seal all conduits entering or leaving hazardous classified areas with approved seals.

.20 Where conduits pass through walls, group and install through openings. After all conduits shown on the Drawings are installed, close wall openings with material compatible with the wall construction. Review size and quantity of conduit sleeves with the Contract Administrator.

.21 Where Drawings show conduit designations, identify these conduits at each point of termination and at 50 m intervals with Thomas & Betts "Ty-Rap" No. TY532M labels.

.22 Where conduit finish is damaged, repair or replace.

.23 Use "Condulet" fittings for power and telephone type conduit terminations in lieu of boxes where support is not provided.

.24 All branch circuit wiring, home-runs, communication and data to be minimum 20 mm diameter unless otherwise stated.

.25 Provide necessary flashing and pitch pockets, making watertight joints where conduits pass through roof or watertight membranes.

.26 Where panelboard branch circuit conduits are amalgamated, do not exceed 25 mm diameter in size.

.27 Feed all conduit entries to motors, field devices, instruments, control stations, cabinets and panels in process areas from the side. Where this is not possible, permission must be obtained from the Contract Administrator for other means of entry. Maintain minimum 150 mm clearance above finished floor.

.28 Install sleeves and rough opening as required in advance of concrete pours.

.29 Sleeves shall extend 100 mm above floor or have concrete curbing to provide mechanical protection and water stop.

END OF SECTION

WIRES AND CABLE 0-1000V

1. GENERAL

1.1 Work Included

.1 Provide a complete system of wiring, making all connections necessary for the installation shown on Drawings.

1.2 References, Codes and Standards

.1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.

.2 Install and rate power cables in accordance with the Canadian Electrical Code requirements, or in accordance with ICEA requirements where permissible.

1.3 Product Data

.1 Submit product data in accordance with Section 16010 – Electrical General Requirements.

2. PRODUCTS

2.1 Building Wires

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of chemically XLPE material rated RW90.

2.2 Teck Cable

.1 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.2 Insulation:

.1 Chemically XLPE rated type RW90, 1000 V.

.3 Inner jacket: PVC material.

.4 Armour: interlocking aluminum.

.5 Overall covering: thermoplastic PVC material.

.6 Fastenings:

.1 One hole malleable iron straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1500 mm centers.

.3 6 mm diameter. threaded rods to support suspended channels.

.7 Connectors:

.1 Watertight approved for TECK cable.

2.3 Control Cables

.1 Type LVT: two (2) soft annealed copper conductors, sized as indicated, with thermoplastic insulation, and outer covering of thermoplastic jacket.

.2 Low energy 300 V control cable: solid stranded annealed copper conductors sized as indicated, with PVC insulation type TW with shielding of wire braid over each pair and overall covering of PVC jackets.

.3 600 V type: stranded annealed copper conductors, sizes as indicated with PVC insulation type R90, XLPE type with shielding of wire braid each pair of conductors and overall covering of thermoplastic jacket interlocked armour and jacket over sheath of PVC.

2.4 Luminaire Wire

.1 Type TEW: Copper conductors, #14 AWG, with thermoplastic and asbestos insulation, flame retardant, heat and moisture resistant, rated 600 V, 105^{o}C.

3. EXECUTION

3.1 General

.1 Minimum conductor size #12 AWG except for luminaire drops which can be #14 AWG if fed from 15A circuits.

3.2 Installation of Building Wires

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 16111 – Conduits, Conduit Fastenings and Conduit Fittings.

.2 In trenches in accordance with Section 16106 – Installation of Cables in Trenches and in Ducts.

3.3 Installation of Teck Cable 0 - 1000 V

.1 Install cables.

.2 Group cables wherever possible on channels.

.3 Install cable in trenches in accordance with Section 16106 – Installation of Cables in Trenches and in Ducts.

.4 Terminate cables in accordance with Section 16151 – Wire and Box Connectors - 0 – 1000 V.

3.4 Installation of Aluminum Sheathed Cable

.1 Group cables wherever possible on channels.

.2 Install cable in trenches in accordance with Section 16106 – Installation of Cables in Trenches and in Ducts.

.3 Terminate cables in accordance with Section 16151 – Wire and Box Connectors - 0 – 1000 V.

3.5 Installation of Control Cables

.1 Install control cables in conduit, underground ducts or by direct burial.

.2 Ground control cable shield.

3.6 Installation of Luminaire Wire

.1 Run wires from outlet boxes through luminaire raceways, splice and connect in raceways. Connect continuous rows of luminaires to circuit without breaking conductors.

3.7 Workmanship

.1 Before pulling wire, ensure conduit is dry and clean. If moisture is present, thoroughly dry out conduits; vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease. Employ suitable techniques to prevent damage to wire when ambient temperature is below the minimum permitted for each insulation type. Do not pull wires into incomplete conduit runs.

.2 Installation to be free of opens and grounds. Before energization, measure insulation resistance and comply with the Canadian Electrical Code. Submit data sheet with values measured.

.3 Do not install any conductor smaller than #12 AWG, except where specifically indicated otherwise, i.e. for fire alarm system station circuits, P.A. wiring, etc.

.4 Provide sizes of conductors as shown on Drawings. Voltage drop from lighting panels to farthest outlet must not exceed 2% at full load in any case. Advise Contract Administrator if problem is foreseen.

.5 Exercise care in stripping insulation from wire. Do not nick conductors.

3.8 Identification, Coding and Balancing

.1 For branch circuit wiring, follow identification system shown on the Drawings and as specified in Section 16010 – Electrical General Requirements.

.2 Connect single phase equipment to minimize imbalance on feeders. Adjust branch circuiting shown as required for optimum balancing. Record all changes on Record Drawings.

.3 Colour code all feeders at all terminations, at all points where taps are made, and at all panelboards, switchboards, motor control centres, etc. Use two wraps of 3M #471 plastic film tape 48 mm wide.

.4 Conductors sized No. 10 and smaller are required to be factory coloured, not taped On-Site.

.5 For direct current wiring use red for positive and black for negative.

3.9 Testing

.1 All power and control wiring shall be tested for insulation resistance value with a 1000 V megger. Resistance values shall be as recommended by the cable Manufacturer.

.2 All wire test results shall be properly tabulated, signed, dated, and submitted to the Contract Administrator.

END OF SECTION

OUTLET BOXES, CONDUIT BOXES AND FITTINGS

1. GENERAL

1.1 Work Included

.1 Provide a complete system of boxes for the installation of wiring and equipment.

1.2 References

.1 CSA C22.1-Canadian Electrical Code, Part 1.

2. PRODUCTS

2.1 Outlet and Conduit Boxes General

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 Outlet Boxes for Metal Conduit

.1 Materials:

.1 Surface or recessed concealed type: Die formed steel, hot dip galvanized, 1.25 oz/sq. ft. minimum zinc coating.

.2 Surface mounting exposed: Cast ferrous for threaded conduit, with attached lugs, corrosion resistant two coats finish.

.2 Components:

.1 Ceiling outlets, surface mounting, concealed:

.1 101 mm square, depth 54 mm, Iberville 52171 series

.2 119 mm square, depth 54 mm, Iberville 72171 series

.2 Ceiling outlets, concealed mounting in concrete:

.1 101 mm octagonal concrete rings, depth from 38 mm to 152 mm Iberville 54521 series.

.2 Extension ring to change from recessed conduit to exposed conduit, 101 mm octagonal, 38 mm deep square Iberville 53151-1/2 or 38 mm deep octagonal Iberville 51151C or 54 mm deep, Iberville 55171C.

.3 Wall boxes, concealed in concrete or masonry: for one and two gang applications: 101 mm square, 54 mm deep, 52171 series complete with suitable 52-C-49 series square cornered raised tile wall cover for proper device and wall surface application. Masonry boxes may be used for line voltage switching.

.4 Wall outlets, concealed non-masonry construction, with plaster finish: For one or two gangs used with switches, receptacles, etc., use 54 mm deep Iberville 52171 series, with matching plaster covers, depth to suit. Alternately, use 119 mm square boxes, Iberville 72171 series and covers as required. (For more than two gangs use solid boxes Iberville GSB series with GBC series cover, or special boxes as required).

.5 Wall outlets, surface, exposed mounting or used for outdoor outlets: One or more gang, Crouse-Hinds FS series or FD series, condulet.

.6 Floor Outlets, concealed: Of a type adjustable after box secured, permanently watertight concrete type, sheet steel, T & B #1963.

.7 Covers: Unless wiring devices and plates are mounted, provide blank, round canopy covers to match boxes.

.8 For 347 V switches: Non-interchangeable with 120 V switches through special tapped mounting ears, with top and bottom knockouts only, Iberville #1110-HV Series or Iberville MBX-1-HV, or MBD-1-HV Series.

2.3 Outlet Boxes for Rigid PVC Conduit

.1 Materials:

.1 Rigid PVC boxes and fittings: Unplasticized PVC.

.2 Components:

.1 Floor boxes: Round with threaded hubs for threaded female connectors.

2.4 Masonry Boxes

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.5 Concrete Boxes

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.6 Conduit Boxes

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.7 Fittings - General

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

3. EXECUTION

3.1 Installation

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Install all outlets flush and surface mounted as required for the installation.

.6 Surface mount above suspended ceilings, or in unfinished areas.

.7 Adjust position of outlets in finished masonry walls to suit course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes.

.8 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.

.9 Use plaster rings to correct depth. Use 30 mm on concrete block.

.10 Do not use sectional boxes.

.11 Provide boxes sized as required by the Canadian Electrical Code.

.12 Install vapour barrier material to surround and seal all outlet boxes located on exterior walls of building. Maintain wall insulation.

.13 Outlets installed in party walls to be offset by a minimum of one stud space.

.14 Provide ceiling outlet boxes for every surface mounted fixture or row of fixtures installed on suspended "hard" ceilings.

.15 Primary bushings in termination box for cable connection.

.16 Secondary bushings in termination box for bus duct connection.

.17 Control junction box.

.18 Stainless steel nameplate and connection diagram.

.19 Identify all boxes in accordance with Section 16010 – Electrical General Requirements.

END OF SECTION

WIRING DEVICES

1. GENERAL

1.1 Work Included

.1 Provide and connect all wiring devices for the complete installation.

2. PRODUCTS

2.1 Manufacturer

.1 Wiring devices to be of one manufacture throughout the Work.

.2 Manufacturer's shall be Hubbell, Smith and Stone, Bryant or Pass & Seymour.

2.2 Devices

.1 The catalogue numbers shown below are for the particular Manufacturer's series and all necessary suffixes shall be added for the requirements as stated. For all devices, use the specification grade minimum, and wherever possible, use devices of the same manufacture.

.2 Devices to be ivory with stainless steel coverplates in all but mechanical areas unless noted otherwise. Use galvanized steel coverplates in mechanical areas and for surface mounted devices.

2.3 Switches

.1 347 V, 20 A, single and double pole, three and four-way: As Hubbell No.18221, 18222, 18223 and 18224.

.2 120 V, 20 A, single and double pole, three and four-way: As Hubbell No. 1221, 1222, 1223 and 1224.

.3 For wet locations use the following switches: 20 A, 120 V single pole ivory, and side wired press-switch, as Hubbell #1281.

.4 Provide manually - operated general purpose AC switches with the following features:

.1 Terminal holes approved by AWG #10 wire.

.2 Silver alloy contacts.

.3 Urea or melamine molding for parts subject to carbon tracking.

.4 Suitable for back and/or side wiring.

2.4 Receptacles

.1 Duplex 20 A, 120 V, 3 wire, ivory, U-ground, as Hubbell No. 6252, with the following features:

.1 Ivory urea molded housing.

.2 Suitable for #10 AWG for back and side wiring.

.3 Eight back wired entrances, four side wiring screws.

.4 Break-off links for use as split receptacles.

.5 Triple wipe contacts and rivetted grounding contacts

.6 Dual 15/20 A configuration.

.2 Duplex 15 A, 120 V, 3 wire, ivory, U-ground ground fault receptacle, as Hubbell No. GF-52621A.

.3 Single 15 A, 120 V, 3 wire clock receptacle with stainless steel plate, as Hubbell No. 5235.

.4 Single 30 A, 250 V, 4 wire receptacle with stainless steel cover, as Hubbell No. 9430.

.5 Single 50 A, 250 V, 4 wire range receptacle with stainless steel cover, as Hubbell No. 9450.

.6 Floor outlets, as Smith and Stone VIP Series or Odessey Controls Modular System c/w frames, as required, and receptacles and outlets, as indicated.

2.5 600 V Interlocked Receptacles

.1 Interlocked receptacle with enclosed disconnect switch.

.2 NEMA 4X enclosure complete with viewing window.

.3 30 Amp rating, or as specified on Drawings.

.4 NEMA type HD heavy duty 3 pole safety switch.

.5 3 wire, 4 pole receptacle.

.6 Crouse-Hinds Arktite WSRD series.

2.6 Coverplates

.1 Provide coverplates for all wiring devices, including but not limited to receptacles, telephone, computer, and television.

.2 Use sheet steel utility box cover for wiring devices installed in surface mounted utility boxes.

.3 Use stainless steel 1 mm thick coverplates on all wiring devices mounted in flush-mounted outlet boxes unless otherwise specified.

.4 Weatherproof double lift spring - loaded cast aluminum coverplates, complete with gaskets for single receptacles or switches.

.5 Weatherproof spring - loaded cast aluminum coverplates complete with gaskets for single receptacles or switches.

.6 Use gasketted DS cast covers on FS and FD type boxes.

.7 For all 347 V switch plates, use stainless steel with the voltage pressed or engraved on the plate.

3. EXECUTION

3.1 Installation

.1 Install single throw switches with handle in the "UP" position when switch closed.

.2 Install switches vertically in gang type outlet box when more than one switch is required in one location.

.3 Mount switches on the latch side of the doorway as close as possible to door frame unless otherwise indicated on drawings.

.4 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.

.5 Protect cover plate finish with paper or plastic film until all painting and other work is finished, then remove paper.

.6 Install suitable common coverplates where wiring devices are grouped. Do not distort plates by tightening screws excessively.

.7 Do not use coverplates meant for flush outlet boxes on surface mounted boxes.

.8 Wherever possible, mount equipment in a straight line at a uniform mounting height, coordinated with other equipment and materials.

.9 Mounting dimensions are to the centre of the devices. Final instructions on mounting heights shall be given by the Contract Administrator at the Site. The dimensions given in Section 16010 – Electrical General Requirements shall be used as a guide, but is subject to final verification prior to installation.

.10 Supply and install a separate neutral conductor from branch circuit panel to devices for all dimmer control circuits.

END OF SECTION

WIRE AND BOX CONNECTORS 0 - 1000 V

1. GENERAL

1.1 Work Included

.1 Provide a complete system of wiring, making all connections necessary for the installation shown on Drawings.

1.2 Special Codes

.1 Install and rate power cables in accordance with the Canadian Electrical Code requirements or in accordance with IPCEA requirements where permissible.

1.3 References

.1 CSA C22.2 No. 65 Wire Connectors.

.2 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 A Maximum Rating).

2. PRODUCTS

2.1 Materials

.1 Pressure type wire connectors: with current carrying parts same material as conductors sized to fit the conductors as required.

.2 Fixture type splicing connectors: with current carrying parts same material as conductors sized to fit the conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded or solid round copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper bar.

.5 Bolts for aluminum bar.

.6 Sized for conductors as indicated.

.4 Clamps or connectors for Teck cable and flexible conduit, as required.

2.2 Wire Connectors

.1 Use 3M "Scotchlock", self-insulated connectors for hand twist wire joints for lighting, small power, and control wiring.

.2 Use T & B non-insulated ring type compression lugs for terminating #10 AWG and smaller motor connections. Tape with rubber and scotchtape. Lugs to accept ten - 32 x 3/8" machine bolts.

.3 Terminate conductors #8 AWG and larger with Thomas & Betts Colour-Keyed compression connectors Series 54000, or on lugs provided with equipment.

.4 Thomas & Betts "KOPR-SHIELD" compound Series CP8 on all terminations for compression connectors.

3. EXECUTION

3.1 Installation

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by Manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.2 Wire Connectors

.1 Select hand twist connectors for wire size and install tightly on conductors.

.2 Brush "KOPR-SHIELD" compound on terminations for compression connectors as recommended by the Manufacturer.

.3 Install compression connectors using methods and tools recommended by Manufacturer.

.4 Do not install stranded conductors under screw terminals unless compression lugs are installed.

END OF SECTION

FASTENINGS AND SUPPORTS

1. GENERAL

1.1 Work Included

.1 Supply and install all hangers, supports and inserts for the installation shown on the Drawings and specified herein, as necessary to fasten electrical equipment securely to the building structure.

2. PRODUCT

2.1 Framing and Support System

.1 Materials:

.1 Intermediate duty supporting structures: Aluminum strut channel together with the Manufacturer's connecting components and fasteners for a complete system.

.2 Heavy duty supporting structures: fabricated from welded steel structural members and hot dipped galvanized before installation.

.3 Nuts, bolts, machine screws: stainless steel.

2.2 Concrete and Masonry Anchors

.1 Materials: Hardened steel inserts, zinc plated for corrosion resistance. Epoxy adhesive type.

.2 Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of 4.

.3 Manufacturer: Hilti (Canada) Limited.

2.3 Non-Metallic Anchors

.1 Material: Plastic anchors for sheet metal screws.

.2 Manufacturer: Fischer.

2.4 Conduit Supports

.1 General: Malleable iron one-hole conduit straps where exposed to weather. Stamped steel two-hole straps indoors.

.2 Structural Steel: Crouse-Hinds "Wedgetite" supports or equivalent manufactured by Appleton.

.3 Masonry, concrete, stone, etc.: Anchors.

.4 Title: Toggle bolts.

.5 Metal studs, ceiling hangers, etc.: "Caddy-Clips".

.6 Unistrut: Unistrut conduit clamps.

2.5 Cable Supports and Clamps

.1 General: As per conduit supports, except that for single conductor cables, use suitable non-ferrous, or approved stainless steel or aluminum clamps.

3. EXECUTION

3.1 General

.1 Do not cut or drill beams, joists or structural steel unless written permission of the Contract Administrator is obtained.

.2 Distance between conduit or cable supports not to exceed code requirements.

.3 Supports to be suitable for the real loads imposed by equipment.

.4 Supports to be securely fastened, free from vibration and excessive deflection or rotation. Maximum deflections are 4 mm over a 1 m span and 8 mm over a 2 m span.

.5 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with Manufacturer's installation recommendations.

.6 Provide conduit rack with 25% spare capacity for multiple runs.

.7 Provide channel support with fittings for vertical runs of conduit and cables.

3.2 Installation

.1 Secure equipment to tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete and concrete masonry with adhesive anchors.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole malleable iron or steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support two or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.7 Use plastic anchors for light loads only. Use metal anchors for all other loads.

.8 Shot driven pins may only be used with written approval of the Contract Administrator.

.9 Use round or pan head screws for fastening straps, boxes, etc.

.10 Do not support heavy loads from the bottom chord of open web steel joists.

.11 Support outlet boxes, junction boxes, panel tubs, etc., independent of conduits running to them. Support conduits within 600 mm of outlet boxes. Support surface mounted panel tubs with a minimum of four 6 mm fasteners.

.12 For surface mounting of two or more conduits use channels at 1.5 m oc spacing.

.13 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.14 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.15 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.16 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Contract Administrator.

END OF SECTION

TESTING, ADJUSTING AND BALANCING OF ELECTRICAL EQUIPMENT AND SYSTEMS

1. GENERAL

1.1 Intent

.1 Except where otherwise specified, arrange and pay for testing, adjusting, balancing and related requirements specified herein.

.2 If test results do not conform with applicable requirements, repair, replace, adjust or balance equipment and systems. Repeat testing as necessary until acceptable results are achieved.

.3 Provide all labour, materials, instruments and equipment necessary to perform the tests specified.

.4 All tests shall be witnessed by persons designated by the City, who shall also sign the test documentation.

.5 Submit procedures proposed in writing for approval two (2) weeks prior to test.

1.2 Related Work

.1 Section 16010 – Electrical General Requirements.

1.3 Manufacturer's Production Test Records

.1 If requested, submit copies of production test records for production tests required by EEMAC and CSA standards for manufactured electrical equipment.

1.4 Site Testing Reports

.1 Log and tabulate test results on appropriate test report forms.

.2 Submit forms to Contract Administrator for approval prior to use.

.3 Submit completed test report forms as specified, immediately after tests are performed.

1.5 Reference Documents

.1 Perform tests in accordance with:

.1 The Contract Documents

.2 Requirements of authorities having jurisdiction

.3 Manufacturer's published instructions

.4 Applicable CSA, IEEE, IPCEA, EEMAC, and ASTM standards

.2 If requirements of any of the foregoing conflict, notify Contract Administrator before proceeding with test and obtain clarification.

1.6 Manufacturer's Site Services

.1 Arrange and pay for the site services of approximately qualified Manufacturer's representatives where Site testing, adjusting, or balancing of electrical equipment or systems' performed by Manufacturer's representatives is:

.1 Specified, or

.2 Otherwise required to ensure that electrical equipment and systems are operational in full compliance with the Contract Documents

1.7 Sequencing and Scheduling

.1 Except where otherwise specified, perform all testing, adjusting, balancing and related requirements specified herein prior to Interim Acceptance of the Work.

.2 Perform voltage testing and adjusting after user occupancy or utilization of facility.

2. PRODUCTS

2.1 Test Equipment

.1 Provide all equipment and tools necessary to perform testing, adjusting and balancing specified herein and as otherwise required.

3. EXECUTION

3.1 Testing of Wiring and Wiring Devices

.1 All power and control wiring shall be tested for insulation resistance value with a 1000 V megger. Resistance values shall be as recommended by cable Manufacturer. Test results shall be properly tabulated, signed, dated and submitted with maintenance manuals.

.2 Test service grounding conductors for ground resistance.

.3 Test all wiring devices for correct operation.

.4 Test all receptacles for proper polarity and circuitry.

3.2 Ground Resistance Testing

.1 Measure ground resistance with earth test meter to verify compliance with CSA C22.2 No. 0.4 and Canadian Electrical Code.

END OF SECTION