REGIONAL MUNICIPALITY OF WOOD BUFFALO

STANDARD CONSTRUCTION SPECIFICATIONS

MARCH 2021

Tender Certification Letter - Template

Date: _____
File: _____

Regional Municipality of Wood Buffalo
9909 Franklin Avenue
Fort McMurray, AB T9H 2K4

Re: TENDER CERTIFICATION LETTER
PROJECT NAME: _____

Project Title:	
Project Number:	
Consultant:	
Lead Designer:	
Email Contact Info:	
Telephone Contact Info:	
Tender Document Enclosed:	

This Tender Certification Letter is provided to the Regional Municipality of Wood Buffalo to indicate:

- The tender package has been reviewed and conforms to the standards of the Regional Municipality of Wood Buffalo where possible.
- All changes to the Standard Construction Specifications have been approved by the Regional Municipality of Wood Buffalo's Project Manager with approval of the Director of Engineering.
- The tender package has been reviewed and accepted by the Consultant.

Signature: _____ Signature _____

Print Name: _____ Print Name _____
Lead Designer **Project Manager**

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END OF SECTION

1 General

This Section provides common work restrictions that may affect a construction project. The contact information provided is for general reference however it does not negate the Owner's Representative or Contractor from contacting Alberta One Call before proceeding to work.

The following restrictions relate to:

Working around existing utilities.
Connections to existing services.
Noise generating restrictions.

1.1 WORKING AROUND EXISTING UTILITIES

.1 For locations of underground utilities and pipelines:

Alberta One-Call
1-800-242-3447

.2 The Contractor shall be responsible for the location and protection of all existing utilities and appurtenances, including but not limited to, signs, power poles, streetlights, pad mount transformers, telephone pedestals, legal survey control monuments, buried utility conductors, buried shallow utility lines and buried water, sanitary, and storm sewer mains and services.

.3 Extreme caution is to be exercised at all times, and damage is to be reported and repaired immediately. The costs associated with protection of and repair of all utilities shall be borne by the Contractor.

.4 The Contractor shall be required to contact all the various authorities controlling or owning the referred to infrastructure and services and satisfy itself as to the location of same. If it is necessary to relocate the services because of the construction, the Contractor will negotiate with the authority concerned, with regards to costs, payment and timing but this will not relieve the Contractor of responsibility of damage caused thereto as referred to above.

.5 The Contractor shall provide sufficient notice of the requirement for relocation to the owner of the utility services which may require relocation because of the construction. Existing utility services as shown on the Contract drawings are plotted according to available information but are not necessarily accurate or complete.

.6 The Contractor shall be responsible for notifying the appropriate municipal department and utility companies of their intention to carry out operations in the vicinity of any existing main, line, conduit or other structure or utility, treed and/or natural feature, at least one week in advance of any such operations being carried out. The Contractor shall arrange a site meeting with the Owner's Representative and one

representative of any municipal department or utility company requiring relocation or new installation during construction. The following is a list of utility agencies commonly involved in the Regional Municipality of Wood Buffalo:

.1 Water, sanitary, and storm sewer lines:

The Regional Municipality of Wood Buffalo
Public Works Department
Phone: 1-780-749-7859

The Regional Municipality of Wood Buffalo
Environmental Services Department
Phone: 1-780-799-5823

.2 Overhead or underground electric power lines, streetlighting, traffic control loops, and home runs:

ATCO Electric
Customer Services Representative
Phone: 1-780-799-8706

The Regional Municipality of Wood Buffalo
Public Works Department
Phone: 1-780-749-7859

.3 Overhead or underground electric power transmission lines:

AltaLink Management Ltd. (Calgary Office)
Phone: 1-866-451-7817

.4 Underground natural gas pipelines:

ATCO Gas
Phone: 1-780-799-7940

.5 Overhead or underground telecommunication lines (including fibre-optic):

Shaw Cable Systems Ltd.
Phone: 1-888-472-2222

Telus Communication Inc.
Phone: 1-800-317-3363

MTS Allstream (Formerly A.T. & T Communications Inc.)
Phone: 1-866-282-0111 (Manitoba Office)

Bell Canada
Phone1-877-993-4237

.6 Trees and/or natural features:

The Regional Municipality of Wood Buffalo
Public Works Department
Phone: 1-780-749-7859

.7 The Contractor, at his expense, is to conduct his operations in accordance with the requirements of the utility authorities having jurisdiction.

1.2 CONNECTIONS TO EXISTING MAINS

.1 The Municipality shall make connections to existing water, sanitary and/or storm mains where specified on the Drawings. The Municipality will make the connections using their Standard Operating Procedure.

1.3 NOISE GENERATING WORK

.1 Carry out noise generating work in accordance with the Regional Municipality of Wood Buffalo Noise Bylaw No. 83/024, which states, in part, as follows:

"(1) Unless permission from the Chief Building Inspector of the City for such operation is first obtained, no person shall carry on the construction of any type of structure which involves hammering, sawing or the use of any machine tools or equipment capable of creating a sound which may be heard beyond the boundaries of the site on which the activity is being carried on in any district other than one designated in the Land Use Bylaw as an Industrial District between the hours of:

(a) eleven o'clock in the evening and seven o'clock of the next forenoon on weekdays or;

(b) eleven o'clock in the evening and nine o'clock in the forenoon of the following day which is a Sunday or holiday.

(2) Unless permission from the Chief Building Inspector of the City for such operation is first obtained, no person shall operate or allow to be operated;
(a) a riveting machine,
(b) a concrete mixer,
(c) a gravel crusher,
(d) a steam shovel,
(e) a trenching machine,
(f) a drag line,
(g) an air or steam compressor, jack-hammer, pneumatic drill,
(h) a tractor or bull dozer, or
(i) any other tool, device or machine of a noisy nature so as it creates a noise, confusion or disturbance which may be heard in a residential building between the hours of;

(i) ten o'clock in the evening and seven o'clock of the next forenoon on weekdays or;

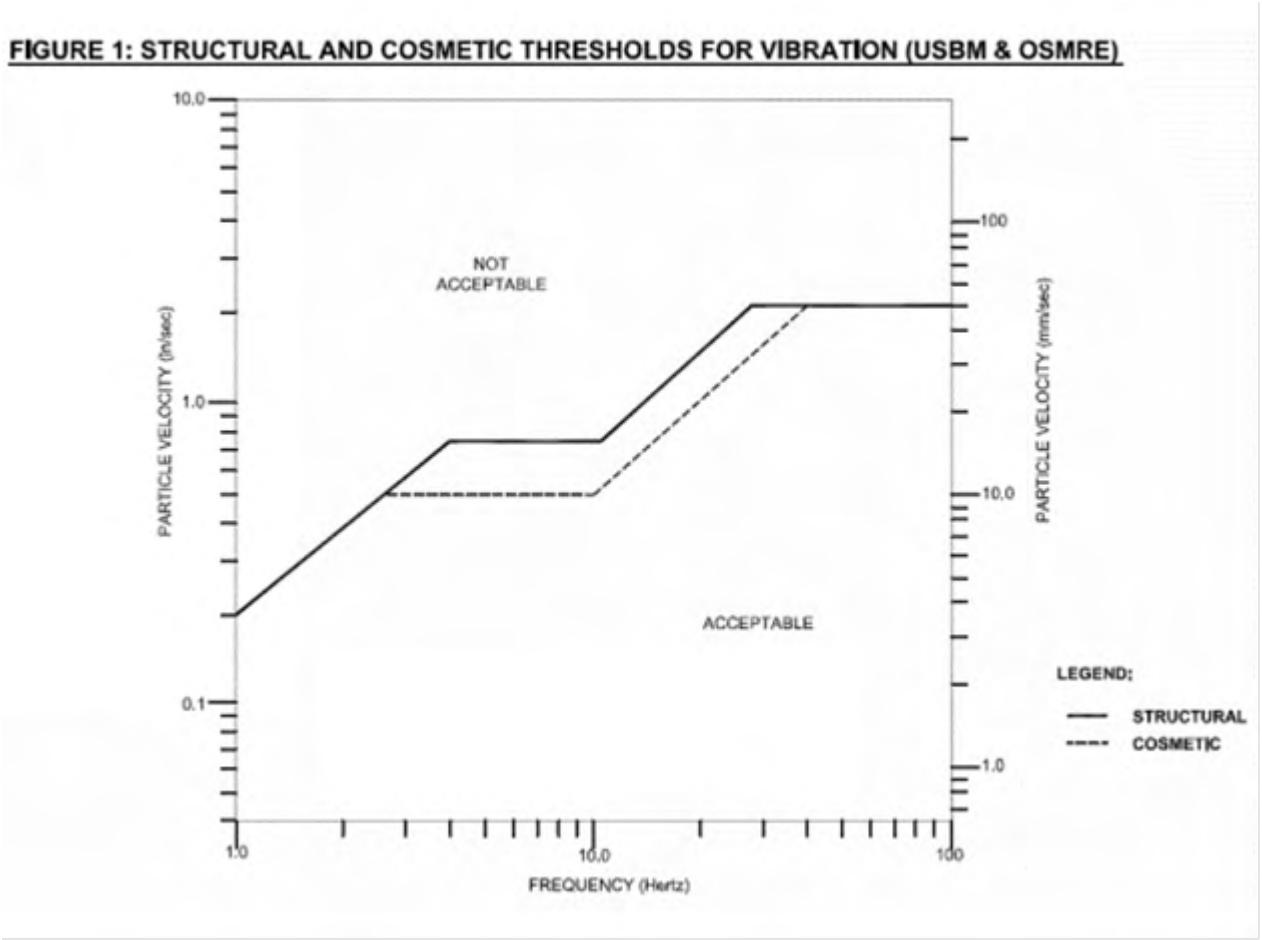
(ii) ten o'clock in the evening and nine o'clock in the forenoon of the following day which is a Sunday or holiday."

1.4 CONSTRUCTION NOISE AND VIBRATION MONITORING

.1 The Contractor is to ensure that construction noise and vibrations do not exceed the levels as described below. The Owner at their discretion may engage a third party to monitor the noise and vibration levels generated at any stage during construction.

.2 All Areas: Conduct construction activities so that vibration levels at a distance of 15 meters from construction limits or at nearest affected building (whichever is closer) do not exceed the cosmetic threshold as listed in Figure 1.

FIGURE 1: STRUCTURAL AND COSMETIC THRESHOLDS FOR VIBRATION (USBM & OSMRE)



1.5 SPECIAL EVENTS

.1 The Contractor is advised that the RMWB has a number of special events that may be scheduled during the construction season. The Contractor is solely responsible to coordinate the work to accommodate the special events. Where access is required for residents' using a wheelchair or other mobility device, asphalt millings shall be used for temporary access to properties. Coordinating the work to accommodate special events shall be considered incidental to the work and no separate or additional payment shall be made.

1.6 SCHOOL SITES

.1 No work will be permitted in the vicinity of school sites during the regular school season. For the purpose of project planning, the Contractor will schedule to commence and complete all works in the vicinity of school sites within the period of July 1 to August 31.

2 Products

2.1 NOT USED

3 Execution

3.1 SOUND ABATEMENT

.1 The Municipality may require the Contractor to undertake a noise impact assessment for the work site. The threshold requiring noise mitigation measures shall be an A-weighted 24-hour equivalent sound level of 65 dB, measured 1.2 metres above ground level and 2 metres inside the work site.

4 Measurement and Payment

4.1 EXISTING UTILITY LOCATING - HYDROVAC

.1 Hydrovac of existing utilities will be measured per hour of hydrovac time operating onsite. The unit rate shall include hydrovac travel time, dumping fees, setup/teardown, leaving the hydrovac hole in a safe condition. The Contractor coordination time shall be incidental to the Contract. Hydrovac time tickets to be reviewed and approved daily by the Owner or Owners Representative.

4.2 CONSTRUCTION NOISE & VIBRATION MONITORTING

.1 The Owner at their discretion may engage a third party to monitor the noise and vibration levels generated at any stage during construction. A provisional cash allowance shall be used. Payment as per GC5.10 Cash Allowances.

END OF SECTION

1 GENERAL

1.1 PROGRESS CLAIMS

.1 Contractor's Responsibilities:

.1 Submit progress claim to Owner’s Representative.

.2 Progress claim to show estimate of percentage of work completed for each lump sum bid item.

.3 Progress claim to show number of units for each unit rate bid item.

.4 Progress claim to include all labour and materials incorporated in the Work and all materials stored at the Site.

.5 Progress claim to include all agreed extras and deductions.

.6 To verify quantities, supply the required documentation including haul tickets, disposal receipts, purchase orders, and other relevant documentation.

.7 Supply documentation to support claim other evidence required by Owner’s Representative in support of progress claim.

.2 Owner’s Representative's Responsibilities:

.1 Review Contractor's claim, prepare Progress Payment Certificate and issue to Owner within 10 business days following receipt of Contractor's claim.

.2 Owner’s Representative's estimate of percentage of work completed will govern calculation of payment on all Progress Payment Certificates.

.3 Inform Contractor of amendments to claim by copy of Progress Payment Certificates.

1.2 CHANGE ORDERS

.1 Complete and promptly return all requests for scope changes, schedule changes, and pricing requests issued by Owner’s Representative.

.2 Make no change in Work unless Change Order issued. Change Order is only valid when signed by Owner’s Representative, Owner and Contractor.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

4 Measurement and Payment

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

1.1 MEETINGS

.1 Pre-construction Meeting

.1 A pre-construction meeting will be arranged by the Owner's Representative after the Contract is awarded.

.2 Meetings will be held at a location determined by the Owner's Representative.

1.2 PROGRESS MEETINGS

.1 Progress meetings will be held on a regular biweekly basis or more frequently if requested by the Owner's Representative.

.2 Accommodation for progress meeting shall be provided by the Contractor at or near the site.

.3 The Owner's Representative will give to all parties advance notice of meeting dates, times, and locations.

.4 The Contractor shall have in attendance the Contractor's Project Manager, Site Superintendent and representatives of the major Subcontractors.

.5 The Owner's Representative will have the Project Owner's Representative and/or the Resident Owner's Representative in attendance.

.6 The Owner will have a representative in attendance and will chair the meetings.

.7 Minutes will be taken by the Owner's Representative and copies will be distributed to attendees.

1.3 COORDINATION OF WORK

.1 General

.1 The Contractor shall delegate the extent of the work of various trades and shall coordinate the work of all trades.

.2 The Owner's Representative will not be an arbitrator to establish limits of any contracts between the Contractor and its Subcontractors.

.2 Work by Others

.1 The Contractor shall coordinate the work of this Contract with the work of all other contractors, utility companies, and work forces.

.3 Work of Subcontractors

.1 Ensure cooperation of Subcontractors in laying out Work. Maintain efficient and continuous supervision.

1.4 FIELD ENGINEERING SERVICES

.1 General

.1 The Owner's Representative will establish benchmarks and monuments and be responsible for their accuracy.

.2 The Contractor shall safeguard all survey control markers, statutory iron posts, and lot corner posts, and shall re-establish, at his expense, all survey control marks, statutory iron posts and lot corner posts, removed without authorization from the Owner's Representative.

.2 Datum Planes

.1 Elevations indicated or specified refer to Geodetic datum unless otherwise stated.

.3 Setting Out

.1 The Contractor shall remove physical obstructions as necessary for the survey crew operation and arrange a survey work schedule with Owner's Representative 48 hours prior to requiring completion of survey work.

.2 The Owner's Representative will establish base lines, control points, lines and grades for work, and may check points, lines, or grades established by Contractor.

.3 The Contractor shall be responsible for the accuracy of his work in relation to the Owner's Representative's benchmarks and monuments.

.4 Assistance to Resident Owner's Representative

.1 The Owner's Representative may require temporary assistance in performing surveys periodically throughout the duration of the Project. The Contractor shall make available upon request of the Owner's Representative a temporary assistant at no additional cost.

1.5 WORK SITE BOUNDARY

.1 Confine the Work and the operations of employees to limits indicated by the Contract Documents. Do not unreasonably encumber the premises with products.

.2 Environmental Procedures (Section 1 07 00 – Environmental Procedures) to be considered when establishing the boundary.

1.6 CONSTRUCTION PARKING

.1 Consult with Owner regarding provision of on-site parking for construction personnel.

.2 Parking will be permitted on site, provided it does not disrupt the performance of the Work.

1.7 PROGRESS PHOTOGRAPHS

.1 The Contractor shall photograph and document the existing conditions of the site, utilities, concrete, asphalt, driveways, and landscaping prior to mobilization.

.2 Throughout the Work schedule either the Contractor or Owner's Representative may take photographs to record progress.

.3 When unique, specialized or difficult conditions arise, photographs of the site, materials and installation should be taken.

.4 If photographs taken, submit to the Owner's Representative on a monthly basis along with regular progress submissions.

.5 If photographs are of a unique, specialized or difficult conditions situation, a copy is to be forwarded to the owner for review.

.6 Photos are not to be taken of people at the site without the appropriate permission.

1.8 ADJACENT PROJECTS

.1 The Contractor will reasonably accommodate adjacent construction projects, in terms of scheduling, phasing, and maintenance of detours and access points.

1.9 SOLID WASTE COLLECTION

.1 Contractor to ensure residential solid waste collection services can be provided for the specific weekday in accordance with the RMWB's schedule posted on the RMWB website:

https://www.rmwb.ca/living/Services-and-Utilities/Garbage-Collection.htm

.2 Where curbside collection cannot reasonably be accommodated, the Contractor will be responsible for collecting all bins, bringing them to an agreed-upon collection point for collection, and returning all bins to the rightful homeowners following collection.

.3 The contractor shall coordinate will all private waste removal services.

.4 In the absence of accommodation of Municipal solid waste collection, the Contractor will be responsible for collection, hauling and disposing of solid waste from the affected areas, in accordance with the legislation.

1.10 CANADA POST

.1 The Contractor will be responsible for notification and coordination with Canada Post for access to public post boxes. The Contractor will be responsible for temporary relocation and reinstatement of any post boxes as a result of construction.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

4 Measurement and Payment

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

This Section details the Contractor's responsibilities to prepare and submit construction schedules.

1.1 SCHEDULES REQUIRED

.1 Submit the following schedules:

.1 Construction Progress Schedule.

.2 Submittal Schedule for Shop Drawings and Product Data.

.3 Submittal Schedule for Samples and Mix Designs.

1.2 FORMAT

.1 Prepare schedule in the form of a horizontal bar chart.

.2 Provide a separate bar for each trade or operation.

.3 Provide horizontal time scale identifying the first workday of each week.

.4 Work listings placed in chronological order of the start by each item.

.5 Sub-listings of work items, identified by specification subjects.

.6 Include key milestones that are established at the preconstruction meeting.

1.3 SUBMISSION

.1 Submit initial schedules within 14 days after award of Contract.

.2 Submit three copies to be retained by the Owner's Representative.

.3 Owner's Representative will review the schedule and return a reviewed copy within 10 days of receipt.

.4 Resubmit finalized schedule within 7 days of receiving the reviewed copy.

.5 Submit dated revised progress schedule with each application for payment. Distribute copies of the revised schedule to:

.1 Job site office;

.2 Subcontractors; and

.3 Other concerned parties.

.6 Instruct recipients to report to the Contractor within 10 days any problems anticipated by the timetable shown in the schedule.

1.4 CONSTRUCTION PROGRESS SCHEDULE

.1 Include the complete sequence of construction activities.

.2 Include the start date and completion date of each major element of construction.

.3 Provide start and completion date for logical segments of the work to track progress towards milestones.

.4 Show projected percentage of completion of each item as of the first day of the month.

.5 Indicate progress (if any) of each activity to date of submission schedule.

.6 Show changes occurring since previous submission of schedule.

- .1 Major changes in scope.
- .2 Activities modified since previous submission.
- .3 Revised projections of progress and completion.
- .4 Other identifiable changes.

.7 Provide a narrative report to define

- .1 Problem areas, anticipated delays, and the impact on the schedule.
- .2 Corrective action recommended and its effect.
- .3 The effect of changes on schedules of other prime contractors.

1.5 SUBMITTALS SCHEDULE

.1 Include schedule for submitting shop drawings, product data, samples, quality control testing, tangible capital assets reporting, operations and maintenance manuals, record drawings

.2 Indicate dates for submitting, review time, resubmission time, float time, last date for meeting fabrication schedule.

1.6 CONSTRUCTION NOTICES

.1 Appropriate advance notice to Businesses, Residents, Engineer and the RMWB must communicated at each notification must be provided. All Communications must go through the RMWB communication department.

.2 The CONTRACTOR is advised that they shall PROVIDE hand delivered notices to the public adjacent to the work according to the following:

- .1 1 month notice before initiation of the WORK.
- .2 2 weeks notice before initiation of the WORK.
- .3 2-day notice before initiation of the WORK.

.4 Construction progress notice every week for the duration of construction. These notices are incidental to the contract and shall be PROVIDED to the OWNER and ENGINEER for review prior to distribution and for posting on RMWB construction web site at the OWNER's discretion.

.3 Responsibility

.1 All construction notices for construction work on behalf of the Municipality are to be created using the templates provided and submitted to the project manager for review. It is the responsibility of the contractor and consultant to understand and follow this process. It is the responsibility of the project manager to communicate this process and ensure compliance.

.4 Construction Notice Overview

.1 Project Introduction Notice

.2 Notice of Construction

.3 Construction Update

.4 Midway Update

.5 Moving to the next Phase of Construction

.6 Driveway Interruption Notice

.7 Accidental Damage to Driveway Notice

.8 Water Interruption Notice

.9 CCTV Sewer Inspection Notice

.10 Closing Temporary Parking Notice

.11 Project Inspection Notice

.12 Project Completion Notice

.13 Project Deferral

.14 Project Suspension

.15 Warranty Work Notice

.5 Process

.1 STEP 1 – The consultant/contractor accesses the RMWB Construction Templates and fills in the project specifics.

.2 STEP 2 – The consultant/contractor sends the project notice to the RMWB project manager.

.3 STEP 3 – The RMWB project manager makes any needed recommendations or edits and sends the project notice to the Communication and Stakeholder Relations team for review. During the review process you may get an email for clarification or for final review prior to the notice going public.

.4 STEP 4 –The Communication and Stakeholder Relations strategist will send back the project notice to the Project Manager for their final approval.

.5 STEP 5 - On behalf of the RMWB, contractors/consultants deliver notices door to door. The Communication and Stakeholder Relations strategist will share these notices with Pulse and load it to the Construction Map (rmwb.ca/constructionmap).

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

4 Measurement and Payment

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

1.1 REQUIREMENTS

.1 Contractor is to engage a qualified surveyor to carry out the construction survey.

.2 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated, for purposes of construction and quantity measurement.

.3 Provide devices needed to lay out and construct work.

.4 Supply such devices as straight edges and templates required to facilitate Owner's Representative's inspection of work.

.5 Supply stakes and other survey markers required for laying out work.

1.2 SURVEY REFERENCE POINTS AND LEGAL SURVEY MARKERS

.1 Locate, confirm and protect control points and legal survey markers prior to starting site work. Preserve permanent reference points during construction.

.2 Locating existing legal pins and delineating all boundaries.

.3 Control points and legal survey markers that will be affected by construction work or will be not visible during construction are to be relocated after written notice and approval of new locations with Engineer.

.4 Make no changes or relocations without prior written notice to Owner's Representative.

.5 Report to Owner's Representative when a reference point or legal survey maker is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.6 The Contractor is responsible for re-establishing the lip of gutter grade along any portion of removed curb and gutter. Where the entire length of curb and gutter will be removed., the Contractor shall establish a hub line behind the curb and gutter for use in recording the lip of gutter elevation and for the re-construction of the lip of gutter at the same elevations.

1.3 SURVEY REQUIREMENTS

.1 Establish lines and levels, locate and lay out, by instrumentation.

.2 Locating existing utilities, right-of-way, structures, etc.

.3 Setting out the Work and all associated diversions and alterations

.4 Ascertaining those premises affected by the Work.

.5 Monitoring the work for diversion from line and level.

.6 Recording all aspects of work.

.7 Submitting all required records.

.8 Relocation of existing survey monuments before start of construction at locations not to be disturbed during construction. Locations are also to be agreed upon with Owner's Representative before relocation

.9 Complete 'As Constructed' surveys and maintain records in accordance with 1.4 and 1.5.

1.4 CONSTRUCTION RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 "As Constructed" information to be recorded in separate field books from layout field books.

.3 "As Constructed" field books to be on-site, with the Contractor, at all times. Owner's Representative to have access to these field books, for reference, at all times.

.4 "As Constructed" information required for:

.1 Pipe invert at each invert entering/exiting a manhole.

.2 Manhole rim elevations.

.3 Top of water main pipe at all vertical deflections.

.4 Horizontal tie to legal control and inverts for: manholes, valves, hydrants, water main fittings, including bends and tees.

.5 Original ground elevation along pipe centerline for each layout station.

.6 Elevation of ground after stripping along pipe centerline for each layout station.

.7 Casing pipe invert and horizontal location of pipe end.

.8 Insulation start, end, thickness and widths.

.9 Asphalt repairs, cold milling and crack repairs, pavement markings

.10 GPS coordinates or as-built survey records of all concrete repairs including but not limited to curb and gutter, sidewalk driveway accesses or pedestrian ramps.

.11 Any deviations from the Contract Documents

.5 Contractor to submit up-to-date "As Constructed" information weekly to Owner's Representative for review. Contractor still responsible for record drawings as described below.

.6 For any section of pipe backfilled without "As Constructed" information recorded, Contractor must, in the presence of Owner's Representative, excavate and have the "As Constructed" information recorded at the Contractors expense.

1.5 RECORD DRAWINGS

.1 Refer to Section 01 11 00 - Closeout Procedures.

1.6 SUBMITTALS

.1 Submit name and address of Surveyor to Owner's Representative, minimum two (2) weeks prior to construction commencing.

.2 On request of Owner's Representative, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by Surveyor certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

4 Measurement and Payment

.1 Include a lump sum for all costs for carrying out all preliminary and continuing survey work associated with the Contract. This includes, but is not limited to the following:

.1 Locating existing legal pins and delineating all boundaries.

.2 Stake out property and easement lines adjacent to construction.

.3 Locating existing utilities, rights-of-way, structures.

.4 Setting out the Work and all associated diversions and alterations.

.5 Ascertaining those premises affected by the Work.

.6 Monitoring the work for diversion from line and level.

.7 Recording all aspects of work.

.8 Submitting all required records.

.9 Relocation of existing survey monuments before start of construction at locations not to be disturbed during construction. Locations are to be agreed upon with Owner's Representative before relocations.

.2 Payment shall be made based on a percentage of the tendered price of overall construction as determined by Owner's Representative.

END OF SECTION

1 General

1.1 REQUIREMENTS INCLUDED

.1 Construction schedule.

.2 Shop drawings and product data.

.3 Samples.

.4 Record drawings and all pertaining reports.

.5 Emergency response plan.

.6 Company safety policy and WCB letter of good standing.

.7 Dust control plan.

.8 Traffic accommodation plan.

.9 Trench design and method plan.

.10 Bypass pumping plan.

.11 Temporary water and wastewater service plan.

.12 Vibration monitoring plan.

.13 Waste management plan.

.14 Site health and safety plan including emergency contract numbers.

.15 Safety Certificate of Recognition.

.16 Erosion and Sedimentation and Control Plan (ESC Plan).

.17 Environmental Construction Operations (ECO Plan).

1.2 ADMINISTRATIVE

.1 Provide submittals to Owner's Representative for review with reasonable promptness and in an orderly sequence so as not to cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 At Owner's Representative request, prepare and submit schedule fixing dates for submission and return of shop drawings, product data or samples.

.3 Work affected by the submittal shall not proceed until review is complete.

.4 Review submittals prior to submission to the Owner's Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project will be returned without being examined and will be considered rejected.

.5 Contractor's responsibility for errors and omissions in submission is not relieved by Owner's Representative review of submittals.

.6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Owner's Representative review.

.7 Keep one reviewed copy of each submission on Site.

.8 Contractor shall submit a dust control plan for the transport of materials to and from the plant and the construction site. The plan shall be submitted prior to the start of construction.

.9 If the Owner's Representative deems the dust control measures undertaken to be inadequate, he/she retains the right to instruct the Regional Municipality of Wood Buffalo to undertake appropriate dust control measures. The cost of such measures will be billed to the Contractor.

.10 Contractor to submit trench design and method to Owner's Representative one month prior to the start of construction.

1.3 CONSTRUCTION SCHEDULE

.1 Refer to Section 1 03 10 – Construction Schedule.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data, which are to be provided by Supplier to illustrate details of a portion of Work.

.2 Detail all shop drawings using the metric system. Prepare to a drafting standard equivalent to Contract drawings.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, wiring diagrams, panel layouts with bills of material, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the Section under which the adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Adjustments made on shop drawings by Owner’s Representative are not intended to change the contract value. If adjustments affect the value of Work, state such in writing to Owner’s Representative prior to proceeding with Work.

.5 Make such changes in shop drawings as Owner’s Representative may require, consistent with Contract Documents. When resubmitting, notify Owner’s Representative in writing of any revisions other than those requested.

.6 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Supplier.

.2 Manufacturer.

.4 Apply shop drawing stamp, signed by Supplier’s authorized representative and the Contractor certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 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 Relationship to adjacent work.

.7 Submit one (1) electronic copy of product data sheets or brochures for requirements requested in specification Sections and as Owner's Representative may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

.8 Submit one (1) electronic print of shop drawings for each requirement requested in specification Sections and as Owner's Representative may reasonably request.

.9 Submittals will be returned with one or more of the following notations. Take action as noted:

.1 "REVIEWED" - Make and distribute additional copies as required for execution of Work.

.2 "REVISE & RESUBMIT" - Make the necessary revisions and resubmit revised drawings for review. Show the drawing number of the first such revised drawing and show the latest revision number applicable to the drawing by adding a suffix to the drawing number as - "REV. 1", "REV. 2", etc.

.3 "NOT REVIEWED" - This notation indicates when Owner's Representative has not reviewed the drawing. It may also be used in combination with the notation to revise and resubmit the drawing where Owner's Representative lacks sufficient information to complete his review and requires to resubmit the drawing for review after revision.

.4 Drawings will be marked "REVIEWED" together with the notation to "REVISE & RESUBMIT" when Owner's Representative requires Supplier to resubmit a revised drawing showing corrections made as a result of Owner's Representative's notations on the shop drawings. This procedure will not relieve Supplier of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of Contract.

.10 Use only those shop drawings on the work that bear the "REVIEWED" notation.

.11 Do not revise shop drawings marked "REVIEWED" unless resubmitted to Owner's Representative for further review.

.12 Where more than one type of shop drawing has been specified for one item, e.g., wiring diagrams, layout details, and dimensional drawings, the shop drawings shall be submitted together, to enable Owner's Representative to review the drawings as a package.

.13 Catalogue pages or drawings applicable to an entire family or range of equipment will not be accepted as shop drawings unless they are clearly marked to show the pertinent data for the particular materials.

.14 Manufacturers' catalogues, manuals, or price lists will not be accepted as shop drawings. Such materials may be used as supplemental information to the shop drawings.

.15 Indicate the tag number of instruments and valves and clearly show the features and details applicable to the equipment being supplied.

.16 Determine which shop drawings have, in addition to those drawings specifically mentioned in the Contract, design elements requiring the seal of a Professional Owner’s Representative registered in the Province or Territory where the work is located, in accordance with the applicable provincial or federal Engineering acts or other governing legislation. Seal such drawings before submitting them for review. Submit for review engineering calculations signed by the registered Professional Engineer responsible for the shop drawing design elements.

.17 If upon review by Owner’s Representative, no errors or omissions are discovered or if only minor corrections are made, one copy will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through the same procedure indicated above, and must be performed before fabrication and installation of Work may proceed.

.18 Owner may deduct, from payments due to Supplier, costs of additional work incurred if correct shop drawings are not submitted after one review by Owner’s Representative.

.19 Review by Owner’s Representative is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Owner’s Representative approves the detail design inherent in the shop drawings, responsibility for which remains with Supplier, and such review does not relieve Supplier of the responsibility for errors or omissions in the shop drawings or of the responsibility for meeting all requirements of the Contract Documents. Supplier is responsible for dimensions to be confirmed and correlated at the job-site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.

1.5 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples as to origin and intended use in the Work.

.2 Deliver samples prepaid to Owner's Representative business address.

.3 Notify the Owner's Representative in writing, at the time of submission, of deviations in samples from requirements of Contract Documents.

.4 Adjustments made on samples by the Owner's Representative are not intended to change the Contract Amount. If adjustments affect the value of Work, state such in writing to the Owner's Representative prior to proceeding with the Work.

.5 Make changes in samples which the Owner's Representative may require, consistent with Contract Documents.

1.6 RECORD DRAWINGS

.1 Submit record drawings to Owner's Representative, per Section 1 11 00 - Closeout Procedures, upon completion of Work and prior to final inspection.

1.7 CERTIFICATE OF RECOGNITION

.1 Submit a photocopy of a valid Certificate of Recognition (COR) prior to expiry of a previously submitted COR or Temporary Letter of Certification.

1.8 DOCUMENT CONTROL PROCEDURES

.1 ALL submissions must be sent with covering Transmittal.

.2 Transmittals will be primarily exchanged via email. The Owner's Representative will provide a FTP site to be used for large submissions (when required).

.3 Multiple documents/ or submissions can be sent per Transmittal.

.4 The Owner's Representative will review the transmittals, ensure it is complete as per the Transmittal list, acknowledge as received, date and return to the Contractor.

.5 When the Owner's Representative's Transmittals are sent to the Contractor, they must be acknowledged as received, dated and the Transmittal page returned via email to the Owner's Representative.

.6 There are no revisions to Transmittals. Revisions to the documents submitted can be completed (and often will be) however a new Transmittal with new Transmittal number must be started for revised documents.

.7 The Owner's Representative's Transmittal Numbers do not correspond with the Contractor's Transmittal Number.

.8 Schedules must be sent via Transmittal. Covering letter outlining schedule change must also be included to substantiate the reason for change.

.9 Transmittals from Subcontracts will not be directly sent to the Owner's Representative. They must be forwarded through the Prime Contractor with a Prime Contractor Transmittal or RFI Form.

.10 RFIs will be initiated by the Prime Contractor and sent via email (ie- no Transmittal required). The Owner's Representative's response will also not have a Transmittal; it will be the "Response" to the RFI.

.11 RFIs can have revisions (ie- RFI_062_R1). However, if there is a revision prior to an RFI "Response", please indicate whether the initial revision is:

a) SUPERSEDING the previous RFI.

b) ADDING TO the previous RFI.

.12 Contract Change Orders (CCOs) and Change Order Price Requests (CCPRs) will be initiated by the Owner's Representative and sent via email with covering letter (ie- no Transmittal). CCOs numbering will start at 01 (ie- CCO#01) and continue upwards.

.13 Filling out CCPRs includes filling in:

.1 the unit rate(s).

.2 total cost of each line item.

.3 the extension of the number of days.

.4 signing the CCPR .

.5 dating the CCPR.

(This information cannot just be sent back in a letter. It must be completed on the CCPR form).

.14 Contract Change Order Request (CCRs) will be initiated and submitted by the Contractor:

.1 they MUST each have a Number (ie- CCR No. 001) in order to track them.

.2 this Number must be referenced in the letter (if a letter is being provided).

.3 these must be submitted via Transmittal.

.4 if there is a revision, please indicate if the original is being SUPERSEDED or ADDED TO.

2 Products

.1 Not used.

3 Execution

.1 Not used.

4 Measurement and Payment

4.1 SUBMITTALS

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

1.1 REFERENCE STANDARD

.1 Traffic control to be in accordance with the current Regional Municipality of Wood Buffalo Utility Installation and Traffic Control Manual (available from the Regional Municipality of Wood Buffalo).

1.2 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out work or haul materials or equipment.

.2 When working on travelled way:

.1 Place equipment in position to present minimum of interference and hazard to travelling public.

.2 Keep equipment units as close together as working conditions will permit and preferably on same side of travelled way.

.3 Do not leave equipment on travelled way overnight.

.3 Do not close any lanes or any road without approval of Owner's Representative. Before re-routing traffic, erect suitable signs and devices in accordance with instructions contained in the Regional Municipality of Wood Buffalo, Utility Installation and Traffic Control Manual. Provide sufficient crushed gravel to ensure a smooth riding surface during work.

.4 Load trucks in a manner that will prevent spillage and tracking of soil or debris on roadways. Clean up immediately to the satisfaction of the Owner's Representative if spillage or tracking does occur. Clean haul routes daily or as directed by the Owner's Representative. Failure to clean up haul routes may result in the Regional Municipality of Wood Buffalo crews doing the cleaning without notice to the Contractor and the costs will be deducted from moneys due to the Contractor.

.5 Traffic Accommodation Plan shall be provided and reviewed by Owner's Representative for all hauling, lane closures etc. and all work incidental to traffic control.

1.3 INFORMATIONAL AND WARNING DEVICES

.1 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from project work which may require road user response.

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in Part D, Temporary Conditions, of manual titled Uniform Traffic Control Devices for Canada.

.3 Place signs and other devices in locations recommended in said manual.

.4 Meet with Owner's Representative prior to commencement of work to prepare list of signs and other devices required for project.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to conditions existing from day-to-day.

1.4 PROJECT SIGNS

.1 The Contractor is to supply and install project sign(s) at the project boundaries. If the project has definite boundaries, then one sign shall be installed at each end of the project. If the project boundaries are not clearly defined, then one sign shall be installed at a prominent location for each neighbourhood and shall include all the street names/locations.

.2 Sign printing, erection, safety, maintenance, and removal upon completion will be the Contractor's responsibility and will be paid for under the Lump Sum as noted on the Bid Form. No additional payments will be made.

.3 The contactor shall provide posts (min 100mm x 100mm) and/or a bracing arrangement to withstand the weather for the duration of the project.

.4 Project sign should be erected at a safe location that will not pose safety issues or obstruct the traffic sight lines.

.5 The Project Sign should be formatted as per the image below and meet the following specifications:

.6 Completion date to be formatted in the following manner:

.1 Single Year Project: Month &Year (ex. October 2019)

.2 2-3 Year Project: Season & Year (ex. Fall 2019)

.3 3+ Year Project: Year (ex. 2019)

.4 Size of sign: 2.4m x 1.2m (8’ x 4’)

.5 Structure and Framing:

.1 New construction grade lumber, structurally adequate and suitable for exterior application

.2 Sign Mounting Material: Crezon or approved equal Plywood

.3 Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles, minimum 19 mm

.4 Rough Hardware: Galvanized steel, of sizes and types to enable sign assemblies to resist wind loads (minimum post size 100mm x 100mm)

.5 Use minimum 13 mm diameter button head carriage bolts to fasten sign panels to supporting structures or #10 x 63.5 mm zinc wood screw spaced at 152.4 mm on centre. Bolt heads to be painted to match sign face

.6 The Contractors logo should be in white reversed, same or smaller in proportion to the municipal logo and in the lower right corner.

.7 PROCESS

.1 STEP 1 – SUBMITALS

.1 Submit complete Shop Drawings identifying locations, materials and RMWB Engineering Project Signage template

.2 Submit signs in accordance with Section 1 04 00 Submittal Procedures

.2 STEP 2 – PROJECT IDENTIFICATION

.1 Provide one sign at the project site, or one at each end of the Project if it is a linear roadway project, or one at each location if the project includes separate work sites, and laydown yards as applicable. The sign should be 3-square meter area, with a minimum dimension of 1.2 meters.

.2 Erect the sign(s) on the site at a safe location of high public visibility, adjacent to main entrance to site or project, as approved by the RMWB Project Manager.

.3 STEP 3 – INSTALLATION

.1 Install project identification signs within 5 days of commencement of mobilization on the construction site

.2 Set signs and level and solidly brace as required to prevent displacement during the construction period

.3 Install project signs at a height for optimum visibility, in safe location, on ground mounted poles or attached to temporary structural surfaces.

.4 STEP 4 – MAINTENANCE

.1 Maintain signs and supports in a neat, clean condition; repair damages to structure, framing, or sign.

.2 Relocate informational signs as required by the progress of the Work.

.3 Poorly maintained, defaced, damaged, or dirty signs shall be replaced, repaired, or cleaned without delay, at no additional cost.

.4 Special care must be taken to ensure that construction materials and dust are not allowed to obscure the face of a sign.

.5 Signs not in effect shall be covered or removed.

.5 STEP 5 – REMOVAL

.1 Remove signs, framing, supports, and foundations at completion of the work.

.2 Leave areas clean and patch as required to remove any traces of temporary signs.

1.5 VARIABLE MESSAGE LED SIGN BOARDS

.1 The Contractor shall supply variable message LED sign boards and regularly update the message to keep residents informed of upcoming work and impacts to regular traffic patterns. Signs are to be located at outside the limits of construction at all main accesses.

.2 Sign supply, installation, safety, maintenance, and removal upon completion will be the Contractor's responsibility and will be paid for under the Lump Sum as noted on the Bid Form. No additional payments will be made.

.3 The following are the requirements for the mid-size full matrix trailer mounted portable changeable message sign boards:

- .1 Dimensions and Weight
  - .1 Length: Minimum 150 inches
  - .2 Width: 2030mm (80 inch) footprint
  - .3 Traveling Height: Maximum 2750mm (108 inches)
  - .4 Operating Height: Minimum 4570mm (180 inches)
  - .5 Axle/suspension: Minimum 1580 kg (3,500 lb)
  - .6 Weight: Maximum 771 kg (1,700 lb)
- .2 Electrical
  - .1 Minimum 8 batteries
  - .2 120-volt AC connection
  - .3 Battery Charger
  - .4 Solar powered with battery surcharge protection.
  - .5 Cellular connection
  - .6 Radar gun
  - .7 Laptop connection
  - .8 Remotely programmable from PC
  - .9 On site programable using unit keyboard controller
  - .10 Easy-to-read 178mm (7-inch) color LCD pressure sensitive display screen
  - .11 Ability to save all messages for quick reuse.
  - .12 User-friendly one-click icon-based menu items

.3 Display

.1 Display panel: 1.6m x 2.5m (63 in. x 98 in.)

.2 Full matrix of 30 x 48 pixels

.3 4 LEDs per pixel

.4 Up to 3 lines of 8 character per line

.5 Display sign rotates 360 degrees for perfect setting.

.6 Plug-and-play display modules for simplified maintenance

.4 Overall Construction

.1 Powder coating superior finish - Impact, humidity, salt spray and rust resistant

.2 4 leveling jacks for stabilization and easy transportation

.3 Electro-hydraulic lift mechanism for quick and effortless deployment

.4 Plastic battery boxes to minimize battery corrosion.

.5 Lockable control box for security

.6 76mm (3 in) pintle eye for easy towing

.5 Miscellaneous

.1 Operator’s Manuals

.2 Parts Manuals

.3 Service/repair manuals complete with electrical schematics.

1.6 TEMPORARY PARKING

.1 In such projects where temporary parking is required, each temporary parking location is to have an RMWB Temporary Parking Sign posted (using the provided template). One week prior to closing the temporary parking lot an RMWB Temporary Parking Closure Sign must be mounted over top the initial sign (using the provided template).

.2 The Contractor shall be responsible for coordination of temporary parking and it is to be included in the Contractor Traffic Accommodation Plan. The costs for a shuttle bus are to be included for residents with limited mobility.

1.7 CONTROL OF PUBLIC TRAFFIC

.1 Ten (10) days prior to undertaking any construction, the Contractor shall submit in writing, his intended system of routing traffic during construction, to the Owner's Representative. The Contractor's system of routing traffic will be reviewed by the Owner's Representative and the Regional Municipality of Wood Buffalo with the Contractor and any modifications requested, at any time, by the Owner's Representative or the Municipality, shall be immediately implemented.

.2 The desire for this project is to minimize disruption to traffic (both public and service vehicles) to the greatest extent possible. Lane closures should be limited to those sections being actively worked on and should re-opened to public traffic as soon as possible.

.3 Provide competent flag persons, properly equipped as specified in Manual of Uniform Traffic Control Devices for Canada, in following situations:

.1 When public traffic is required to pass working vehicles or equipment which may block all or part of travelled roadway.

.2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.

.3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

.4 Where temporary protection is required while other traffic control devices are being erected or taken down.

.5 For emergency protection when other traffic control devices are onto readily available.

.1 In situations where complete protection for workmen, working equipment and public traffic is not provided by other traffic control devices.

.2 Traffic signs shall be erected and maintained to ensure safety of workers and public as required in the Regional Municipality of Wood Buffalo Traffic Accommodations in Work Zone Manual. Phasing of the construction to be as shown on drawings.

.4 Provide competent flagpersons, properly equipped as specified in manual of Uniform Traffic Control Devices for Canada, in following situations:

.1 When public traffic is required to pass working vehicles or equipment which may block part of travelled roadway.

.2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.

.3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

.4 Where temporary protection is required while other traffic control devices are being erected or taken down.

.5 For emergency protection when other traffic control devices are onto readily available.

.6 In situations where complete protection for workmen, working equipment and public traffic is not provided by other traffic control devices.

1.8 PUBLIC TRANSPORTATION

.1 Contractor must notify Public Transit, prior to construction, of any potential disruptions. Contractor and public transit officials to coordinate any rerouting required.

2 Products

.1 Not used.

3 Execution

.1 Not used.

4 Measurement and Payment

4.1 TRAFFIC CONTROL & ACCOMODATION

.1 Include a lump sum for all costs involved in Traffic Control..

.2 The lump sum price will be paid as a percent complete approved by Owner’s Representative.

4.2 PROJECT SIGNS

.1 Include a lump sum for all costs involved with the Project Sign(s)

.2 The lump sum price will be paid as a percent complete approved by Owner’s Representative.

4.3 VARIABLE MESSAGE LED SIGN BOARD

.1 Include a lump sum for all costs involved with the Variable Message LED Sign Board(s)

.2 The lump sum price will be paid as a percent complete approved by Owner's Representative.

4.4 TEMPORARY PARKING

.1 Include a lump sum for all costs involved arranging for temporary parking, shuttles, communication, and signage.

.2 The lump sum price will be paid as a percent complete approved by Owner's Representative.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Province of Alberta

.1 Occupational Health and Safety Act, R.S.A.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 1 04 00 - Submittal Procedures.

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Award Letter and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site-specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.4 Submit copies of incident, accident and near miss reports and investigations.

.5 Submit WHMIS SDS or MSDS – Safety Data Sheets or Material Safety Data Sheets.

.6 The Owner’s Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 business days.

.7 The Owner’s Representative’s review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.8 Medical Surveillance: where prescribed by legislation, regulation, or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to the Owner’s Representative.

.9 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Owner’s Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.4 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

1.5 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Act, Occupational Health and Safety Regulation, Occupational Health and Safety Code,, Alberta Reg.

1.6 UNFORESEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety co-ordinator and follow procedures in accordance with Acts and Regulations of Alberta having jurisdiction and advise Owner’s Representative verbally and in writing.

1.7 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience specific to activities associated with the Work.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Not be under direct supervision of the site supervisor.

1.8 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Alberta having jurisdiction, and in consultation with Owner’s Representative.

1.9 BLASTING

.1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Owner’s Representative.

1.10 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Owner’s Representative.

1.11 CONSTRUCTION SAFETY MEASURES

.1 Observe construction safety measures of National Building Code, Provincial Government, Workers'/Workmen's Compensation Board and municipal authority provided that in any case of conflict or discrepancy more stringent requirements shall apply.

.2 Contractor is designated Prime Contractor for the construction site.

1.12 OVERLOADING

.1 Ensure no part of Work is subjected to loading that will endanger its safety or will cause permanent deformation.

1.13 FALSEWORK

.1 Design and construct falsework in accordance with CSA S269.1.

1.14 SCAFFOLDING

.1 Design and construct scaffolding in accordance with CSA S269.2

1.15 WHMIS

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

.1 Until the end of the transition period, December 1, 2018, if there are no products with WHMIS 2015 SDS labels onsite, the worksite must comply with WHMIS 1988 requirements.

.2 Where a product onsite has an SDS label complying with WHMIS 2015, the worksite must comply with WHMIS 2015 requiremrnts.

.3 An employer is permitted to apply a worksite label in compliance with WHMIS 1988 and comply with WHMIS 1988 but must ensure the SDS contains all information listed in Schedule 1 of the former *Controlled Product Regulations*.

.4 Where an employer has products that meet both WHMIS 1988 and WHMIS 2015 on the worksite, the employer must comply with both systems concurrently unless they choose to follow .3 above.

.2 Deliver copies of WHMIS data sheets to Owner's Representative on delivery of materials.

.3 Post WHMIS data sheets at the work site and ensure that all of the Contractors' personnel are aware of the WHMIS data and recommended precautions are followed.

1.16 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Owner's Representative.

.2 Provide Owner's Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Owner's Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.17 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

2 Products

.1 Not used.

3 Execution

.1 Not used.

4 Measurement and Payment

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

1.1 FIRES

.1 Fires and burning of rubbish on site not permitted.

1.2 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into storm or sanitary sewers.

.3 Contain and remove site waste and materials to a specified and designated waste handling facility and comply with all pertinent acts and regulations for the handling and transportation of waste.

1.3 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump any water directly into RMWB infrastructure. Water may be directed towards infrastructure by overland flow.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with legislative requirements.

.4 When pumping or discharging surface and excavation water to RMWB infrastructure and the environment, prior to release the water must be sampled to ensure compliance with CCME Surface Water Quality Guidelines and RMWB Bylaw limits.

.5 Maintain existing drainage facilities affected by the Work in good operating condition at all times during construction.

.6 Erosion and sedimentation controls to be installed at all drainage routes to intercept runoff from the construction site. Erosion and sedimentation controls to be installed in accordance with the ECO Plan, ESC Plan, drawings, specifications, best management practices, and documented requirements from environmental regulators.

1.4 SITE CLEARING AND PLANT PROTECTION

.1 Vegetation removal is not permitted during the restricted activity periods of Owls or Migratory Birds and setbacks must be adhered to as referenced in the Wildlife Act. All site clearing is to be completed in accordance with all applicable regulations for restricted activity periods including:

- .1 Migratory Birds;
- .2 Nesting Owls; and
- .3 Caribou Calving
  - .1 Caribou Plans must be submitted before November 30th.

.2 RAP dates and setbacks can be found in the Alberta Government's Integrated Standards & Guidelines

.3 Buffer areas will be established at time of Bird Survey and will require protection from clearing until such time that the Owner's Representative's biologist approves the area for clearing.

.4 A resident and property owner engagement must occur before removing any trees.

.5 Protect trees and plants on site and adjacent properties where indicated.

.6 Plant material to be preserved on the site shall be of high quality and worthy of preservation. All plant material to be preserved shall be approved by the RMWB Parks Department.

.7 Temporary protection by way of fencing or flagging is required for all plant material to remain on site. Protection will be required for trunks, branches and root systems of all plant material to be saved. "Close cut" clearing (hand clearing) shall be utilized adjacent to areas to be preserved to ensure no damage to existing plant materials and root systems. All close cut and hand clearing to be inspected by the RMWB Parks Department.

.8 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.9 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.

.10 Passage of heavy equipment, stockpiling gravel, soil or building materials and spillage of fuels, oil, solvents and other chemicals is not allowed in preserved areas.

.11 Existing grades around plant material are to be retained. If grades are to be raised or lowered around plant material to be preserved, the Contractor will be responsible for constructing proper soil retention to ensure the health of the plant material.

1.5 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control features installed under this contract.

.2 Control emissions from equipment and plant to local authority's emission requirements.

.3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.4 Provide dust control during all truck transport activities.

1.6 WORK ADJACENT TO WATERWAYS

.1 Construction equipment to be operated on land only.

.2 Do not occupy or travel over bed, bank, shore or waterbodies without approval of Alberta Environment and Parks

.3 Work on or near waterways can only be conducted as per approval of Alberta Environment and Parks and/or legislation. Project should be reviewed by SUS to determine potential regulatory requirements.

.4 Use waterway beds for borrow material only after written receipt of approval from Owner's Representative.

.5 Waterways to be kept free of excavated fill, waste material and debris.

.6 Design and construct temporary crossings to minimize erosion to waterways as per regulations and/or approval.

.7 Do not skid logs or construction materials across waterways.

.8 Avoid indicated spawning beds when constructing temporary crossings of waterways.

.9 Blasting is allowed only above water and 100 m minimum from indicated spawning beds.

1.7 WORK WITHIN KEY WILDLIFE AND BIODIVERSITY ZONES

.1 All work within Key Wildlife and Biodiversity Zones will require approval from Alberta Environment and Parks and must comply with the conditions of the approval.

1.8 WORK WITHIN CARIBOU HABITAT ZONES

.1 All work within Caribou Habitat Zones will require approval from Alberta Environment and Parks and must comply with the conditions of the approval.

2 Products

.1 Not used.

3 Execution

.1 Not used.

4 Measurement and Payment

.1 Include a lump sum for all costs involved in Environmental Protection.

.2 The lump sum price will be paid as a percent complete approved by the Owner's Representative.

END OF SECTION

1 General

1.1 PURPOSE

.1 The purpose of the *Environmental Construction Operations Plan* **(*ECO Plan*)** is to ensure best management practices are incorporated into construction activities to protect the environment at all stages of the project development.

.2 The ECO Plan is a ***project specific*** document ***prepared by the Contractor***.

.3 The requirements under this Section are intended as a ***supplemental guide*** for the Contractor in the preparation of the ECO plan, and to ensure that the Contractor coordinates the ECO Plan submission and implementation with the Erosion and Sedimentation Control requirements.

.4 This Section **does not** replace or supersede existing mandated policies, regulations and guides of the Regional Municipality of Wood Buffalo, Province or Federal Authorities.

.5 The ***Overall Site ECO Plan*** shall address and incorporate the continued management within the Contract Limits of the site, including erosion and sedimentation monitoring and measures, storm water management system, and the coordination of other separate designated Contract Areas as they become active and incorporated into the Project.

.6 The Overall Site ECO Plan will be a core document of the ***concurrent*** management of the Overall Site and the incorporation and coordination of all other existing and future designated Contract work as the Project develops.

.7 The Contractor can retain a Consultant experienced with ECO Plan requirements and preparation of submissions for approval, or alternatively prepare the documentation with its own forces.

1.2 SUBMITTALS

.1 Reference

.1 Refer to Alberta Transportation's Environmental Construction Operations Plan (ECO Plan) Framework, (Current Edition).

http://www.transportation.alberta.ca/Content/docType245/Production/eco5.pdf

.2 The Contractor shall prepare the following submissions:

.1 ECO Plan for the Overall Site.

.2 Incorporate approved Erosion and Sedimentation Control Plans (ESCP).

.3 Omit items not pertaining or relevant to the project specific requirements.

.4 Coordinate with all Drawings and Specifications under this Contract.

.3 Submit the required documentation within 2 weeks after Notice of Award:

.1 Four (4) copies of the ECO Plan submission.

.2 Do not commence any Work on site until the documentation submitted under this and related Sections are approved.

2 Products

2.1 NOT INCLUDED

3 Execution

3.1 REGULATORY REQUIREMENTS

.1 Comply with all Federal, Provincial and Municipal legal and regulatory requirements and determine all applicable and relevant environmental legislation for this project.

.2 Be aware of all relevant bylaws affecting activities on site and comply with all bylaw requirements.

3.2 RESPONSIBLE PERSONNEL

.1 Provide a detailed list of responsible personnel and their roles for the various phases and activities required under the ECO Plans. This includes a description of the various responsibilities to be undertaken. This documentation shall be **initialed** by the responsible individuals. These responsibilities shall include but are not limited to those responsible for:

.1 ECO Plan Implementation.

.2 Training and awareness of all personnel engaged on the project and the site specific and general requirements of the Project.

.3 Monitoring and Reporting.

.4 Material and Waste Management Procedures.

.5 Erosion and Sedimentation control, inspection and maintenance measures.

.6 Emergency Preparedness and Response.

.7 Communications.

.8 Environmental Issues.

3.3 SITE ACTIVITIES AND MITIGATIONS

.1 Provide a written or tabulated description of all proposed procedures for mitigating construction activities that shall have potential effects on the environment. This shall include at a minimum:

.1 Contractual Requirements

.2 Site Activity Descriptions

.3 Regulatory requirements

.4 Applicable Construction Procedures and Best Management Practices.

.2 Provide a Site Management Plan, which will describe and illustrate the day-to-day activities of the Project from start up to completion of the Contract. The Site Management Plan for the ECO Plan submissions shall address, at a minimum the following items:

.1 Site layout and boundaries indicating proposed Contract boundary.

.2 Site setup for construction staging.

.3 Temporary site utilities, water, and sewage requirements during the course of construction activities.

.4 Parking requirements

.5 Fuelling and Maintenance Areas.

.6 Equipment Storage.

.7 Security and Access requirements.

.8 All materials and waste handling requirements.

.9 Location for general recycling materials and storage, if used.

3.4 EMERGENCY PROCEDURE AND RESPONSE

.1 Provide a description and tabulation of potential environmental emergency procedures and responses in coordination with the ECO Plan submission.

.2 Provide a breakdown of these emergency procedures and responses that include at minimum:

.1 Operational Requirements.

.2 Release Reporting.

.3 Comply with all Municipal, Provincial and Federal environmental emergency procedures and requirements in this regard.

3.5 TRAINING AND AWARENESS

.1 Provide a training and awareness plan which shall ensure that all site personnel are, at a minimum, fully aware of the following:

.1 The requirements of the Project specific ECO plans.

.2 Environmental issues of the Project site and the surrounding area.

.3 Procedures and actions for all construction activities.

.4 Emergency preparedness.

.5 Roles and responsibilities.

3.6 MONITORING AND REPORTING PROCEDURES

.1 Develop and provide a site-specific monitoring program and plan for the Overall Site. Include as a minimum the following:

.1 Map and description of all monitoring points throughout the site including their purpose and function.

.2 Description of frequency and type of monitoring activities.

.3 Documentation procedures.

.4 Reporting procedures.

.5 Action plan, timelines and follow up procedures for deficiencies and non-compliance.

.2 The Contractor shall be responsible for implementation of these monitoring procedures and documentation.

3.7 DOCUMENTATION PROCEDURES AND REQUIREMENTS

.1 Complete and maintain all necessary reports, logs and forms for the project and provide the Owner's Representative regular documentation for the Project on a bi-weekly basis, or period determined at the outset of the Contract.

.2 Provide a communications plan to ensure that both internal and external communications procedures are clearly identified.

3.8 ECO PLAN REVIEW

.1 Ensure that the Overall Site ECO Plan is reviewed and updated on a **weekly** basis and ensure that all documentation is available at the construction site. Provide written updates and appropriate forms at the regularly scheduled progress meeting.

.2 The review process must include a written summary of actions and procedures based on regular environmental inspections and will be incorporated by the Contractor into ECO Plan updates.

.3 Ensure that Project Specific ECO Plan submissions by other Contractors are integrated and coordinated with the Overall Site ECO Plan prepared under this Contract and that all parties are made aware of coordination requirements and issues as they arise.

.4 Approval of progress payments applications will be contingent on fulfilling requirements of ECO Plan reporting.

4 Measurement and Payment

4.1 ECO PLAN

.1 Include a lump sum for all costs involved in preparing and implementing the Environmental Construction Operations Plan.

.2 The lump sum price will be paid as a percent complete approved by the Owner’s Representative.

END OF SECTION

1 General

1.1 REQUIREMENTS INCLUDED

.1 Regulations affecting the Work imposed by:

.1 Regional Municipality of Wood Buffalo.

.2 Alberta Transportation and Utilities.

.3 Alberta Environment and Parks.

.4 Telephone Companies, Cable Companies and other Shallow Utility Companies.

.5 Federal Legislation

.2 Regulatory requirements means laws, bylaws, ordinances, rules, regulations, codes, orders of Authorities Having Jurisdiction, and other legally enforceable requirements applicable to the Work and which are or become in force during the performance of the work.

1.2 COMPLIANCE WITH REGULATIONS

.1 Ascertain requirements and regulations of local authorities (gas/power/telephone service providers, Regional Municipality of Wood Buffalo, Alberta Environment and Parks, etc.).

.2 Comply with all such requirements and regulations as applicable to the Work.

.3 Requirements set out in this Section are for guidance and information and are not necessarily complete.

.4 Comply with all additional regulatory requirements not listed here, however, outlined in sections throughout this Contract Document.

1.3 PERMITS

.1 Obtain all construction permits necessary to perform the Work.

.2 The Contractor shall apply for, obtain, and pay for all necessary permits to perform/complete the work.

1.4 WORK IN VICINITY OF OVERHEAD POWER LINES

.1 Request power company to relocate, de-energize or guard any energized conductor where construction equipment may operate within 3 m of conductor.

.2 Obtain power company approval prior to operating any equipment within 3 m of energized conductor.

.3 Where practical, avoid storage of metallic pipe sections under high voltage overhead power lines.

.4 If pipe sections must be stored under power lines, protect personnel from effects of induced currents by grounding pipe sections at two (2) locations with AWG #2 copper ground conductors and grounding rods.

1.5 WORK IN WATERCOURSE

.1 Comply with the following requirements for all work within the high-water mark of the River.

.1 Engage Department of Fisheries and Oceans (DFO) and Alberta Environment and Parks upon project award.

.2 Restrict all work within the wetted perimeter to the minimum necessary to construct the Works, and to the Restricted Activity Period of the water body.

.3 Undertake all work in a manner that will prevent the release of sediment into the water.

.4 Riprap and other materials placed within the high-water mark of the river to be clean and free of silt, overburden, debris, and other substances deleterious to aquatic life.

.5 Restrict removal and disturbance of topsoil, forest cover, and vegetation adjacent to the river to the minimum necessary to construct the Works.

.6 Remove all temporary works, including false work, shoring, cofferdams, temporary bridges, access ramps, and protective works from the site. Reinstate river channel to the condition and configuration that existed prior to construction.

.7 Alter or suspend pertinent operations immediately at the request of a fisheries officer. Suspend work if not in compliance with potential approval or regulations.

.8 Submit proposals for review at least 2 weeks prior to any operation within the high-water mark. Include methods intended to isolate activities from the river and means whereby the release of sediment and unacceptable discharges into the river will be controlled.

2 Products

.1 Not used.

3 Execution

.1 Not used.

4 Measurement and Payment

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Mobilization/Demobilization

.2 Temporary Utilities

.3 Construction Facilities

.4 Temporary Controls

1.2 ACCESS

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to work.

.2 Maintain existing roads used for project site access for the duration of the Contract and make good any damage resulting from Contractor's use of these roads.

.3 Clean roadways used by Contractor's equipment regularly or as directed by Owner’s Representative. Any clean-up work not performed in a timely manner will be completed by the Regional Municipality of Wood Buffalo with all relevant cost deducted from final payment.

.4 Do not obstruct hydrants, valve or control pit covers, valve boxes, curb stop boxes, fire or police call boxes, and all other utility controls, warning systems, and appurtenances.

.5 Prior to final inspection, obtain and submit to Owner’s Representative written signed releases from owners of all roads used for site access, verifying that roads have been adequately restored and left in a satisfactory condition.

.6 Trim loads of trucks hauling excavated material, cement, sand, stone, gravel, debris, or other loose material before leaving the site, and ensure that the bodies of such vehicles are tight so that no spillage of loads occurs.

1.3 PEDESTRIAN ACCOMMODATION

.1 Provide and maintain pedestrian accommodation with the project area, as shown on drawings.

1.4 INSTALLATION/REMOVAL

.1 Provide temporary utilities to execute the work expeditiously. This includes temporary water supply.

.2 Make necessary applications to authorities having jurisdiction, obtain required permits, and pay all fees and related charges.

.3 Remove from site all such work after use.

.4 Restore site to clean, sanitary condition.

1.5 DUST CONTROL

.1 Refer to Section 3 03 00 – Dust Control

1.6 STORAGE SHEDS

.1 Provide adequate weather-tight sheds with raised floors, for storage of materials, tools and equipment which are subject to damage by weather.

.2 Maintain storage sheds in a neat, clean condition.

1.7 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

.3 Disinfect facilities frequently.

.4 Remove contaminated soil and material and replace with fresh, clean material.

.5 Dispose of sanitary wastes, in accordance with the applicable regulations, and subject to approval of Owner’s Representative.

.6 Provide all sanitary supplies required for use by the Contractor's work force and staff of Owner’s Representative.

.7 Prohibit the committing of nuisance. Promptly discharge any employee violating such provision.

1.8 SITE ENCLOSURES

.1 Hoarding

.1 Provide barricades, fencing and covered walkways as required by governing authorities for public rights-of-way.

.2 Provide secure, rigid guard railings and barricades around deep excavations.

.3 All work areas shall be completely fenced off at all times using temporary fencing. Fencing shall be rigidly supported, steel grade with a minimum height of 1.8 m. The Contractor shall maintain the fencing throughout the project duration.

1.9 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

1.10 POWER

.1 Arrange, pay for, and maintain temporary electrical power supply as needed in accordance with governing regulations and ordinances.

.2 Install temporary facilities for power, such as pole lines and underground cables, to approval of local power supply authority.

.3 Locate temporary power at designated location, or at an acceptable location subject to approval of Owner’s Representative.

1.11 WATER SUPPLY

.1 Regional Municipality of Wood Buffalo to supply and the Contractor to arrange and coordinate the transport of potable water for hydrostatic and leakage testing.

1.12 MAINTENANCE AND PUBLIC UTILITIES

.1 Arrange work to avoid interruption of utilities serving the public. Pay for damage.

.2 Where interruption of public utilities is unavoidable, obtain prior approval for interruption from responsible authority.

.3 If water service is interrupted temporary water supply is required. Coordinate the use of a fire hydrant through the RMWB Regional Emergency Services.

.4 Provide bypass pumping if sanitary sewer service is interrupted.

.5 As required by utility authority, establish, and pay for temporary relocation of utility during construction.

1.13 MATERIALS TO BE SALVAGED

.1 Remove, clean, deliver, unload, and neatly stockpile at the Regional Municipality of Wood Buffalo Public Works yard materials which are specified or designated by the Owner’s Representative to be salvaged.

.2 Repair or replace at Contractor's expense salvaged materials damaged during removal, unloading or in transit.

1.14 OFFICES

.1 Contractors may provide their own offices, as necessary. Location of these offices to be located in temporary workspace and laydown areas.

1.15 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

1.16 SECURITY

.1 Provide and pay for responsible security personnel to guard the site and contents of the site after working hours and during holidays.

1.17 LAYDOWN AREAS

.1 The Contractor will be fully responsible to procure laydown areas for the duration of construction. The contractor, at their expense, shall remediate the site upon completion to the satisfaction of the site Owner.

1.18 FIRE ROUTES

.1 Maintain all weather access to operational hydrants and property including overhead clearances for use by emergency response vehicles.

1.19 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 All damage to properties outside the proposed work area caused by the Contractor shall be restored at his own expense to the satisfaction of the Owner.

1.20 CONSTRUCTION CLEANING

.1 Maintain the Work in tidy condition, free from the accumulation of waste products and debris.

.2 Remove waste material and debris from the site and deposit in waste container at the end of each working day.

.3 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

.4 Promptly clean up any spillage that occurs on site roads, access roads or public roads, or other areas where construction vehicles are travelling. If hazardous materials are spilled call the 24-hour emergency number (780) 743-7000 or 1-800-973-9663.

.5 If Contractor is negligent in maintaining cleanliness of roads, Owner will arrange for cleaning to be done at Contractor's expense.

2 Products

.1 Not used

3 Execution

.1 Not used

4 Measurement and Payment

4.1 TEMPORARY FACILITIES

.1 Include a lump sum for all costs involved in preparing the site for the execution of work and leaving the site upon completion of the work. This shall include:

.1 Mobilization,

.2 Demobilization

.3 Contract administration costs.

.4 Bonding and insurance required for the project.

.5 Temporary access.

.6 Temporary fencing and barricades.

.7 Temporary signs, project signs and markings to delineate the site.

.8 Temporary Laydown Areas.

.9 Public and Business Notification Program.

.10 Other site works required for the setting up and control of the work.

.11 Preparation and submission of all pre-construction submission and documents as part of Document Controls.

.12 Record keeping for as-constructed data of all new construction.

.13 Overhead costs, indirect costs and profits associated with “Subject to Deletion” items.

.14 Quality Control.

.2 The lump sum price will be paid as a percent complete approved by the Owner’s Representative.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Quality Assurance Testing

1.2 QUALITY ASSURANCE TESTING BY OWNER

.1 On behalf of the Owner, the Contractor shall retain the services of one or more independent testing agencies for the purpose of quality assurance. This does not relieve the Contractor of his sole responsibility for quality control and testing.

.2 The Materials Testing allowance included shall provide funds for payment of the testing services which the Owner specifically authorizes for his own purposes.

.3 The Engineer's Representative should be on-site while backfilling and compacting is occurring. Failure to have a representative from the Engineer on-site may lead to the Contractor re-excavating and compacting.

2 Products

.1 Not used

3 Execution

.1 At a minimum the following outlines the materials testing requirements to be submitted to the RWMB for quality assurance.

.2 RMWB Master Testing List:

Regional Municipality of Wood Buffalo
Construction Specification Manual
Master Testing List

Specification Section	Item	Testing
2 01 00	Backfill and Pipe Zone - Standard Proctor	1 per material type
2 01 00	Backfill and Pipe Zone - Field Density - Trench	2 tests per 600 mm of depth per 100 m of trench
2 01 00	Backfill and Pipe Zone - Field Density - Pipe Zone	1 test per 100 m of trench
2 01 00	Backfill and Pipe Zone - Field Density - Manholes, Catchbasins, Valves, Valve Chambers and Vaults	Take tests adjacent to manholes, catchbasins, valves, valve chambers and vaults from pipe zone to finished subgrade
2 01 00	Road Base/Sub Base/Subgrade - Standard Proctor/Sieve for Granular	1 per material type
2 01 00	Road Base/Sub Base/Subgrade - Field Density - Subgrade Preparation	1 test per 1,000 m^2
2 01 00	Road Base/Sub Base/Subgrade - Field Density - Sub Base	1 test per 3,000 m^2
2 01 00	Road Base/Sub Base/Subgrade - Field Density - Base	1 test per 1,000 m^2
2 02 10	Manholes and Catchbasins	Leakage Test
2 03 00	Hydrants	Flow Testing
2 03 00	Hydrants	Static Pressure Test
2 03 00	Watermains	Hydrostatic Leakage and Pressure Testing
2 04 00	Sanitary Sewer Mains	Exfiltration Test
2 04 00	Sanitary Sewer Mains	Infiltration Test
2 04 00	Sanitary Sewer Mains	Deflection Test
2 04 00	Sanitary Sewer Mains	Video Inspection
2 04 05	Sanitary Sewer Force Mains	Hydrostatic Leakage and Pressure Testing
2 05 00	Storm Sewer Mains	Exfiltration Test
2 05 00	Storm Sewer Mains	Infiltration Test
2 05 00	Storm Sewer Mains	Deflection Test
2 05 00	Storm Sewer Mains	Video Inspection
3 02 00	Concrete Samples for Testing	One Strength Test Shall Consist of test cylinders for each 50 m^3 of concrete, or portions of each mix type of concrete, or each separate type of structural element in any one day's pour.
3 02 00	Air Content for Concrete	Test every load or batch until such time as satisfactory control of the air content has been established
3 02 00	Slump of Concrete	Made in conjunction with each strength test
3 02 30	Concrete Samples for Testing	One Strength Test Shall Consist of test cylinders for each 50 m^3 of concrete, or portions of each mix type of concrete, or each separate type of structural element in any one day's pour.
3 02 30	Air Content for Concrete	Test every load or batch until such time as satisfactory control of the air content has been established
3 02 30	Slump of Concrete	Made in conjunction with each strength test
3 07 00	Finished Subgrade	Proof Roll to confirm adequate bearing capacity of the subgrade soils
3 07 20	Finished Sub-Base	Proof Roll upon completion of fine grading and compaction
3 07 20	Compacted Granular Sub-Base	One field density test for each lift for each 1,500 m^2, 1000 m^2 of alley, 500 m^2 of walk, monolithic walk, curb ramp, alley crossing, commercial crossing, private crossing, or median island strip.
3 07 30	Finished Base	Proof Roll upon completion of fine grading and compaction
3 07 30	Compacted Granular Base	One field density test for each lift for each 1,500 m^2, 1000 m^2 of alley, 500 m^2 of walk, monolithic walk, curb ramp, alley crossing, commercial crossing, private crossing, or median island strip.
3 08 00	Asphalt Cores for Thickness	Three cores whose average thickness represents not more than 1000 m^2 of asphalt pavement
3 08 00	Samples for Marshall Denisty	One Marshall Density for every 1000 tonnes of hot mix, or a day's production, whichever is less.
3 08 00	Asphalt Cores for Density	One core representing not more than 1000 m^2 of mat, with a minimum of one core taken from a day's production
4 01 40	Topsoil	Owner's Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading

4 Measurement and Payment

4.1 MATERIALS TESTING

.1 Materials testing shall be paid based on the submitted invoices for materials testing from the independent Materials Testing Consultant.

.2 Payment will confirm with terms of GC 5.10 Cash Allowances.

END OF SECTION

1 General

1.1 SUBSTANTIAL PERFORMANCE

.1 Declaration of Substantial Performance

.2 When Owner and Owner's Representative consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed in accordance with the Lien Act, make application for Certificate of Substantial Performance. Acceptance of Substantial Performance will be through the issuance of a Substantial Completion Certificate.

1.2 CONSTRUCTION COMPLETION INSPECTIONS

.1 Contractor's Inspection

.1 Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects; repair as required to conform to Contract Documents. Notify Owner's Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made. Request an Owner's Representative inspection.

.2 Owner's Representative Inspection

.1 Owner's Representative, RMWB PM, and Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. Inspection requires sign-off of RMWB sponsor department. Contractor shall correct Work accordingly.

.3 Construction Completion Certificate

.1 When Owner and Owner's Representative consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for Construction Completion Certificate. The Construction Completion Certificate will state the following:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested and are fully operational.

.4 Owner's personnel have been trained on the operation of systems.

.5 Work is complete and ready for final inspection.

.4 Final Inspection

.1 When items noted above are completed, request a final inspection of the Work by Owner, Owner's Representative, and Contractor. If Work is deemed incomplete by Owner and Owner's Representative, complete outstanding items and request a re-inspection. If work is deemed complete, sign off will be required by all parties.

.5 Re-inspection

.1 Should status of the Work require re-inspection by Owner's Representative due to failure of Work to comply with Contractor's claims for inspection, Owner will deduct amount of Owner's Representative's compensation for re-inspection services from payment to Contractor.

1.3 FINAL CLEANING

.1 In preparation for partial or final acceptance of the project perform final cleaning.

.2 Remove debris and surplus materials from site. This includes tools, construction equipment and machinery not required for performing the remaining work.

.3 Inspect valve boxes, manholes and hydrants to check for debris and proper operation.

.4 Thoroughly clean all surface and components as applicable.

.5 Remove stains and smudges from pain work, hardware and other finished surfaces.

.6 Leave site free of all foreign and surplus materials, cleaning equipment, obstructions and hindrances.

1.4 RECORD DRAWINGS

.1 Owner's Representative will provide two sets of clean white prints for record drawing purposes.

.2 Identify drawings as "Project Record Copy".

.3 Maintain record drawings in new condition.

.4 Owner's Representative and Contractor to work together in preparing the record drawing set to be submitted following substantial completion.

.5 Record neatly and accurately the locations of all asphalt repairs, cold milling and crack repairs, pavement markings, and any deviations from the Contract Documents. Provide photographs and GPS coordinates or as-built survey records of all concrete repairs including but not limited to curb and gutter, sidewalk, driveway accesses or pedestrian ramps.

.6 Mark changes in red. Final record drawings shall incorporate any red line changes on record drawings.

.7 Record following information on one set of prints:

.1 Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement.

.2 Field changes of dimension and detail.

.3 Changes made by Change Order or field direction.

.8 At completion of project and prior to final inspection, neatly transfer notations to second set of prints and submit both sets of record drawings to Owner's Representative.

1.5 LIEN AND WARRANTY PERIODS

.1 Commencement of Lien and Warranty Periods

.1 Date of Owner's acceptance of submitted Declaration of Substantial Performance, issued as Substantial Completion Certificate or Construction Completion Certificate shall be the date for commencement of warranty period and commencement of lien period unless required otherwise by lien statute of the place of the Work.

.2 Warranty of deficiency items will begin once the deficiency has been completed and accepted by the Owner/Owner's Representative.

1.6 FINAL PAYMENT

.1 Following completion of lien period, submit claim for final payment in accordance with the General Conditions.

1.7 FINAL INSPECTION

.1 Prior to completion of the warranty period, the Contractor shall request in writing a final inspection.

.2 Owner and Owner's Representative will carry out an inspection with the Contractor within thirty (30) days of the request.

1.8 FINAL ACCEPTANCE

.1 Final Acceptance Certificate: When Owner and Owner's Representative consider all deficiencies and defects, identified as deficiencies during the maintenance period, have been corrected and it appears requirements of Contract have been totally completed, make application for Final Acceptance Certificate.

2 Products

.1 Not used.

3 Execution

.1 Not used.

4 Measurement and Payment

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C117, Test Method for Material Finer Than: 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).

.4 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).

.5 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 United States Environmental Protection Agency (US EPA)

.1 EPA 832-R-92-005, Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices.

1.2 DEFINITIONS

.1 Rock excavation: excavation of material from solid masses of igneous, sedimentary, or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1 m^3.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan, frozen materials, and partially cemented materials which can be ripped and excavated with heavy construction equipment.

.3 Topsoil:

.1 material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.

.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.

.4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.5 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM C136: Sieve sizes to CAN/CGSB-8.2.

.2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45

.3 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

.6 Native Backfill: material excavated from the trench from which all boulders, roots, stumps, and other debris which would prevent consolidation of backfill have been removed.

.7 Granular Backfill: imported granular material for backfilling trenches in areas above the pipe zone.

.8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

.9 Pipe zone: that portion of the trench between the bottom level of the pipe bedding and a level 300 mm above the top of the installed pipe.

1.3 PROTECTION OF EXISTING FEATURES

.1 Existing buried utilities and structures:

.1 Contractor is advised that the size, depth and location of existing utilities and structures indicated on the Drawings are largely unknown. As such, the size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing any excavation work, notify applicable owner or authorities, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.

.3 Confirm locations of buried utilities by careful test excavations.

.4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain direction of Owner’s Representative before moving or otherwise disturbing utilities or structures.

.5 Advise utility company to remove or re-route existing lines in area of excavation. Cost for such work will be paid by Owner.

.2 Existing buildings and surface features:

.1 Conduct, with Owner's Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey benchmarks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features which may be affected by Work from damage while Work is in progress and repair to as good or better than initial site prior to the Work.

1.4 SHORING, BRACING AND UNDERPINNING

.1 Engage services of qualified Engineer who is registered in Alberta to design and inspect cofferdams, shoring, bracing, and underpinning required for work.

.2 At least 2 weeks prior to commencing Work, submit design and supporting data.

.3 Design and supporting data submitted to bear the stamp and signature of qualified Engineer registered in the Province of Alberta.

.4 Engineer responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where Engineer is employee of contractor, in which case contractor shall submit proof that work by Engineer is included in Contractor's insurance coverage.

1.5 UTILITY INSTALLATION AND STREET OCCUPATION PERMIT

.1 All construction projects that will occupy or block access to municipal lands are required to apply for and receive an approved Utility Installation and Street Occupation Permit a minimum of 5 days and a maximum of 2 weeks prior to starting any construction.

.2 Contractor to apply and obtain Utility Installation and Street Occupation Permit from the Engineering Department a minimum of 3 working days and a maximum of 2 weeks for partial road closure, and a minimum of 5 working days and a maximum of 2 weeks for full road closure prior to commencement of the work.

2 Products

2.1 MATERIALS

.1 Native Backfill: to Section 3 04 00 – Aggregate Materials.

.2 Pipe Zone Material: to Section 3 04 00 – Aggregate Materials.

.3 Type 1 and Type 2 Fill: to Section 3 04 00 – Aggregate Materials.

.4 Type 3 Fill: Selected material from excavation or other sources, approved by Owner's Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.5 Unshrinkable Fill: Proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum Portland cement content of 25 kg/m^3 with 40% fly ash replacement: to CSA-A3001-A5, Type 10.

.3 Minimum strength of 0.07 MPa at 24 h.

.4 Concrete aggregates: to CSA-A23.1/A23.2.

.5 Portland cement: Type 10.

.6 Slump: 160 to 200 mm.

.6 Shearmat: Honeycomb type bio-degradable cardboard 100 mm thick, treated to provide sufficient structural support for poured concrete until concrete cured.

.7 Geotextiles: to Section 3 05 30 – Geotextiles.

3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA 832-R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.3 PREPARATION/PROTECTION

.1 Protect existing features in accordance with the Drawings and applicable local regulations.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to the Owner's Representative's approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are required to remain undisturbed.

3.4 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping after area has been cleared of vegetation.

.2 Strip topsoil to depths as indicated on the Drawings or as directed by the Owner's Representative.

.3 Do not mix topsoil with subsoil.

.4 Stockpile in locations as indicated on the Drawings or as directed by the Owner's Representative.

.5 Stockpile height not to exceed 2 m and should be protected from erosion.

.6 Dispose of unused topsoil to location as indicated on the Drawings or as directed by the Owner's Representative.

3.5 STOCKPILING

.1 Stockpile fill materials in areas designated by Owner's Representative. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with this section...

.2 Obtain permit from authority having jurisdiction for diversion of water course.

.3 Construct temporary Works to depths, heights and locations as indicated on the Drawings or as reviewed by the Owner's Representative.

.4 During backfill operation:

.1 Unless otherwise indicated or directed by the Owner's Representative, remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500mm above toe of sheeting.

.5 When sheeting is required to remain in place, cut off tops at elevations indicated or reviewed by the Owner's Representative.

.6 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.

.2 Remove excess materials from site and restore water courses to conditions indicated or as reviewed by the Owner's Representative.

3.7 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Submit for Owner's Representative's review, details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in accordance with Section 1 07 00 – Environmental Procedures and in manner not detrimental to public and private property, or any portion of Work completed or under construction.

3.8 SUPPORTED TRENCHES

.1 Moveable Trench Wall Support

.1 The installed pipe and its embedment shall not be disturbed when using movable trench boxes and shields. Movable supports shall not be used below the top of the pipe zone unless an approved method is used to maintain the integrity of the embedment material. Before moving supports, place and compact embedment to sufficient depths to ensure protection of the pipe. As supports are moved, finish placing and compaction of embedment material.

.2 Removeable Trench Wall Support

.1 Where sheeting or other trench wall supports are used within or below the pipe zone, ensure the foundation and embedment materials are not disturbed by support removal. Fill any voids left on removal of supports and compact all materials to required densities.

3.9 EXCAVATION

.1 Advise the Owner's Representative in advance of excavation operations.

.2 Any excavation into oilsands materials will require an approved plan from Alberta Environment and Parks for disposal of materials and off-gassing of the material.

.3 Excavate to lines, grades, elevations and dimensions indicated or as directed by Owner's Representative.

.4 Remove concrete, pavement, walks and other obstructions encountered during excavation.

.5 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.

.6 Do not disturb soil within branch spread of trees or shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with saw. Seal cuts with approved tree wound dressing.

.7 Trenches shall be excavated only as far in advance of the pipe laying operation as safety, traffic and weather conditions permit. Caution shall be exercised with respect to structures, piping or other man-made obstacles that may exist within the working area and due consideration given to the protection and support of such properties and structures.

.8 For trench excavation, unless otherwise authorized by the Owner's Representative in writing, do not excavate more than 20 m of trench in advance of installation operations and trenches should be progressively backfilled as the next section is excavated such that only a short section of trench is left open at the end of each day. If located under a road, it shall be backfilled within 24 hours.

.9 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by the Owner's Representative.

.10 Restrict vehicle operations directly adjacent to open trenches.

.11 Dispose of surplus and unsuitable excavated material at an approved location off site.

.12 Do not obstruct flow of surface drainage or natural watercourses.

.13 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.14 Notify the Owner's Representative when soil at bottom of excavation appears unsuitable and proceed as directed by the Owner's Representative.

.15 Obtain the Owner's Representative's approval of completed excavation.

.16 Remove unsuitable material from trench bottom to extent and depth directed by the Owner's Representative.

.17 Where required due to unauthorized over-excavation, correct as follows:

.1 Fill under other areas with base gravel compacted to minimum of 98% Standard Proctor Density.

.18 Hand trim make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.2 Clean out rock seams and fill with concrete mortar or grout to approval of the Owner's Representative.

3.10 TRENCH ALIGNMENT AND DEPTH

.1 The trench shall be excavated so that pipe can be laid to the established alignment and depth with allowance made for specified trench wall clearances and bedding as required.

.2 Prior to excavation of the trench, the Contractor will establish the location at which the pipe shall be installed by setting stakes at 15 metre intervals along a line offset from the centre of the proposed pipe.

3.11 PILING TRENCH MATERIAL

.1 Excavated trench material may be piled alongside the trench provided the near edge of the piled excavated material is maintained a minimum of 1.5 times the depth of the trench away from the edge of the trench and does not endanger persons, the Work or adjacent properties, and the working space is adequate for this purpose.

.2 Where it is not possible to pile material alongside the trench, it shall be hauled out, stockpiled and returned for backfill, or alternatively, wasted and replaced by approved material provided by the Contractor. All stockpiled trench materials are owned by the Regional Municipality of Wood Buffalo.

.3 Prior to piling excavated trench material outside the working area, the Contractor shall obtain written permission from the appropriate landowners.

.4 Piling of excavated material along the trench shall not unduly restrict cross traffic at road intersections. Material shall be cleared from road intersections and provision made for use of the crossroad by traffic as soon as possible after excavation has taken place.

3.12 TRENCH WIDTH

.1 The width of the trench at the bottom shall be such as to permit the pipe to be laid, jointed, bedded and backfilled, all in accordance with the applicable specifications of this contract.

.2 The minimum trench width at the bottom shall be twice the nominal pipe diameter or 450 mm, which ever is greater.

.3 Trench walls shall be of such extra width where required to permit the placing of timber supports, shoring, bracing, or the handling of special items.

.4 Trench walls shall be vertical from the bottom of the trench to at least 300 mm above the top of the pipe.

.5 Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 150 mm below and on all sides of pipe and fittings.

3.13 TRENCH BOTTOM CONDITIONS

.1 Trenches shall be maintained such that pipe can be installed without getting water, mud, silt, gravel, or other foreign material into the pipe.

.2 Material remaining in the trench bottom on completion of machine excavating which has been disturbed or softened by workmen or trench water shall be removed before bedding material is placed. The trench bottom shall be firm and capable of supporting the pipe to be installed, otherwise the bottom shall be stabilized by means of over-excavation or special foundation designed to support the pipe as hereinafter described.

.3 When the material in the trench bottom is deemed by the Owner's Representative to be unstable or otherwise unsuitable for pipe support or the support of appurtenant structures the trench shall be over-excavated to the level at which stable material is encountered and the excavation backfilled to the level of normal bedding with base gravel material. This material shall be compacted to 98% SPD with approved mechanical compactors in lifts having a maximum depth of 300 mm to provide a thoroughly consolidated pipe base.

3.14 PIPE ZONE MATERIAL

.1 Place pipe zone materials as detailed in the construction drawings.

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

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

.4 Compact full width of bed to 95% Standard Proctor Density.

.5 Pipe zone material to be placed in accordance with Standard Details 7-800 and 7-801.

.6 Fill excavation below bottom of specified pipe zone adjacent to manholes or structures with Type 1 Fill.

3.15 PLACING BACKFILL

.1 To prevent damage to the installed pipe, backfill shall be placed in the trench by rolling down a slope and not by pushing it over the edge of the trench and allowing it to drop vertically.

.2 Every effort shall be made to plan the backfilling operation such that exposure of backfill material to wet weather is kept to a minimum.

3.16 BACKFILL ABOVE PIPE ZONE AND SITE GRADING

.1 Backfilling procedures above the pipe zone shall be carried out in accordance with the following:

.1 Native or Type 2 imported granular backfill shall be placed and compaction shall be obtained by using approved, mechanical, power driven compactors. Compaction shall be carried out with soil moisture content such that compaction to 95% of Standard Proctor Density (ASTM D698) is achieved up to an elevation 150 mm from final grade unless indicated otherwise.

.2 Where trenches extend below existing roadways, accesses, trails or parking lots, the backfill should be compacted to at least 97% of the standard proctor density, except for the upper 300 mm of the road subgrade, which should be compacted to 100 % of the standard proctor density.

.3 When trenching in streets which includes the installation of lot service, uniform backfill measures to be implemented. This consists of having the excavation to be a uniform level, 300mm below the design road subgrade elevation. The excavation width is to extend a minimum of 300mm behind the back of concrete. Back of concrete is considered to be back of monolithic walk or back of curb, depending upon the relevant road cross section.

.4 Material that has undergone extreme changes in moisture content during the period between excavation and backfilling operations shall not be used as backfill until the moisture content has been adjusted to satisfactory limits.

.5 Do not proceed with backfilling operations until Owner's Representative has inspected and approved installations.

.6 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.7 Do not use backfill material which is frozen or contains ice, snow or debris.

.8 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.9 Backfilling around installations.

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 h after placing of concrete.

.3 Place layers simultaneously on both sides of installed work to equalize loading.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Owner's Representative.

.10 Place unshrinkable fill in areas as indicated in the Construction Drawings and Contract Specifications.

.11 Consolidate and level unshrinkable fill with internal vibrators.

3.17 DISPOSAL OF EXCESS EXCAVATED MATERIAL

.1 Excess excavated material shall be removed from the trench area at the time of backfilling. It shall not be dumped on private property without the written permission of the Owner of the property. Excess excavated material shall be disposed of off-site at an approved location. Prior to disposing of excess excavated materials, soil testing and consultation with Alberta Environment and Parks must be completed.

.2 Excavated material may not be hauled off-site without prior testing and analysis in accordance with the applicable legislation. Alberta Environment and Parks will provide direction for the soil testing guidelines (either use Tier I, II or Directive 50). Consultation with Alberta Environment and Parks is required to determine compliance with legislation that establishes the level of contamination and the facility/location that can legally accept the material. The legislation exists to ensure virgin soil is not contaminated with material that is hazardous to human health and environmental receptors and pathways.

.3 Prior to a private landowner accepting excavated material of drilling waste from drilling a well or a directional drill for pipeline construction, landowner must have a registered Land Farm, Activities Designation Regulation Division 1, Schedule 2

.4 At no time is any soil/excavated material to be hauled without prior testing and analysis against the applicable legislation. Alberta Environment will provide direction to either use Tier I, II or Directive 50. Prior consultation with the regulators is required to determine compliance with legislation that determines the level of contamination and the facility/location that can legally accept the material.

.5 These laws exist to ensure virgin soil is not contaminated with material that is hazardous to human health and environmental receptors and pathways.

.6 Material to be disposed of shall be shaped or spread and levelled and left in a neat and tidy condition until the disposal plan has been approved.

3.18 QUALITY CONTROL AND QUALITY ASSURANCE

.1 Owner will appoint, in consultation with the Owner's Representative, and reimburse Contractor for services of an independent testing laboratory or agency to perform whatever Quality Assurance surveying, testing, and inspection is deemed necessary by the Owner's Representative to confirm the compliance of the Work within the Contract Documents.

.1 Submit receipts and proof of payment to Owner's Representative for approval.

.2 Payment will be made only for tests requested and approved by Owner's Representative, supported by proof of payment.

.2 Quality Control testing is the responsibility of the contractor – Tests performed by the Owner's Representative will not be quality control tests.

.3 Owner will not pay for or reimburse Contractor for any services related to inspection, or testing of the following:

.1 Inspection and testing required by laws, ordinances, rules, regulations or order of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Test specified to be carried out by Contractor.

.4 Aggregates testing to meet specified gradations.

.4 Where tests or inspections by designated testing laboratory reveal work not in accordance with contract requirements, Contractor shall pay costs for additional tests or inspections as Owner's Representative may require to verify acceptability of corrected work.

.5 Where tests or inspections are called prematurely or the testing laboratory is delayed by the Contractor, the Contractor shall pay all additional costs incurred.

.6 Contractor's Responsibilities:

.1 Furnish labour and facilities to:

.1 Provide access to work to be inspected and tested.

.2 Facilitate inspections and tests.

.3 Make good work disturbed by inspection and test.

.2 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Owner's Representative.

.7 Provide sieve analysis and Standard Proctor Density testing as required by Owner's Representative.

.8 Complete field density tests in accordance with the following table:

Test	**Minimum Test Frequency**
Backfill and Pipe Zone	
Standard Proctor	1 per material type
Field Density – Trench	2 tests per 600 mm of depth per 100 m of trench
Field Density – Pipe Zone	1 test per 100m of trench
Field Density – Manholes, Catchbasins, Valves, Valve Chambers and Vaults	Take tests adjacent to all manholes, catchbasins, valves, and vaults from pipe zone to finished subgrade
Road Base/Sub Base/Subgrade	
Standard Proctor/Sieve for Granular	1 per material type
Field Density – Subgrade Preparation	1 test per 1,000 m^2
Field Density – Sub Base	1 test per 3,000 m^2
Field Density – Base	1 test per 1,000 m^2

4 Measurement and Payment

4.1 TRENCH EXCAVATION AND BACKFILL

.1 Payment for trench excavation, backfill and compaction will be made at the unit price tendered, within the pipe size and depth ranges specified, per lineal metre of trench excavated, backfilled and compacted in accordance with this Section.

.2 Measurement for each type of installation will be made as follows:

.1 Water Mains: Along centre line of main, including hydrant laterals, through valves and fittings.

.2 Sanitary Sewer Mains: From centre of manhole to centre of manhole, or centre of manhole to designated termination point.

.3 Sanitary and Storm Sewer Force Mains: From centre of manhole to centre of manhole, or from designated start point to designated termination point.

.4 Storm Sewer Mains: From centre of manhole to centre of manhole, or from centre of manhole to designated termination point.

.5 Catch Basin Leads: From centre of manhole to centre of catch basin.

.6 Subdrains: From centre to centre of manholes and catch basins, or from centre of manhole/catch basin to designated termination point.

.7 Culverts: Along invert of pipe from inlet to outlet, included beveled end section.

.8 Concrete Encased and Direct Buried Duct Bank: From designated start point to designated termination point, including length through manholes.

.3 Trench depth shall be the vertical distance between the ground surface immediately prior to excavation and the pipe invert as measured at intervals determined by the Owner's Representative. Backfill shall be to the subgrade on roadway or 150mm below finished grade for greenfield work.

4.2 PIPE BEDDING

.1 Sand Bedding: Payment for supply and placement of sand bedding material per this Section will be made at the unit price tendered, within the pipe ranges specified, per lineal metre of sand bedding material installed, measured along the centre of pipe installed. Unit price to include supply and placement of sand bedding material within the pipe zone.

.2 Screened Rock: Payment for supply and placement of screened rock bedding material according to this Section will be made at the unit price tendered, within the pipe ranges specified, per lineal metre of screened rock bedding material installed, measured along the centre of pipe installed. Unit price to include supply and placement of screened rock bedding material within the pipe zone

4.3 UNSUITABLE PIPE FOUNDATION

.1 Payment for supply and placement of screened rock bedding material according to this Section for unsuitable pipe foundation will be made at the unit price tendered per cubic metre (m^3). Unit price to include excavation of unsuitable foundation material and replaced with screened rock.

4.4 ROCK EXCAVATION

.1 Measurement for solid rock excavation to be neat trench width as indicated on the Drawings multiplied by depth of rock from rock surface to 150 mm below pipe barrel multiplied by length. No overbreak to be measured. Measurement for boulders and rock fragments exceeding 1 cubic metre in volume to be determined from three mutually perpendicular dimensions.

.2 Payment for rock excavation shall be made at the unit price tendered.

4.5 PIPE AND UTILITY CROSSINGS

.1 Unless explicitly provided for in the contract, no payment will be made for crossing oil and/or gas pipelines or other municipal mainline utilities or franchise utilities. Include costs in related items. Where provided in the contract, measurement and payment shall be on a lump sum basis for each crossing made.

.2 Notwithstanding the above statements, payment shall not be made where pipeline or utility being crossed falls below pipe being installed or where pipe being crossed was installed under this Contract.

.3 Payment will be made based on the unit price for each crossing and shall include all costs, including but not limited to, support of the utility, utility crossing agreements and utility inspection charges over and above normal excavation costs.

4.6 SHORING, BRACING, COFFERDAMS, UNDERPINNING AND DE-WATERING

.1 Shoring, bracing, cofferdams, underpinning and de-watering of excavation will not be measured separately for payment.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 This section specifies the requirements for dewatering of excavations that occur below the ground water table.

.2 This does not include costs for typical dewatering such as from rain, snowmelt, etc. The Contactor is responsible to construct and manage their site so that any surface water drains away from the work area and no ponding occurs. The cost to pump and to dry any wet material caused by ponding due to negligence of the Contractor shall be considered incidental to the Work and no separate payment will be made.

1.2 PROTECTION

.1 Prevent damage to trees, landscaping, fencing, natural features, benchmarks, existing structures, pavement, surface, or underground utility lines both on and off site, which are to remain. Make good any damage.

.2 The impact of dewatering on the potential settlement of existing structures is a concern. The impact will be reduced if both the duration and drawdown levels of dewatering are minimized.

.3 If groundwater elevations are lowered below that required for construction the Municipality will assess and charge the cost for the repair and restoration of existing structures to the Contractor.

1.3 SUBMITTALS

.1 Submit a detailed plan of the proposed dewatering system to the Owner’s Representative at least 4 weeks prior to commencing work. Submittal to bear the seal of a qualified Professional Consultant registered in the Province of Alberta.

.2 Include the following in the detailed plan:

.1 Plan layout showing the arrangement and location of wells/well points, methods of installation, location of headers and discharge lines and points of discharge disposal.

.2 Back-up system including contingency measures if part or all of the dewatering system fails.

.3 Temporary drainage and pumping facilities.

.4 Dewatering construction staging.

.5 Details of well/well point installation including depth, screen dimension, screen slot size, backfill filter gradation, riser dimensions, pump type and capacity, and header dimensions.

.6 Locations of piezometers and details of installation including depth, backfill, tip type and dimensions, riser pipe.

.7 Estimate of flow rate and duration of dewatering.

.8 Details of plugging method for any piezometers installed within structure footprint.

.3 Advise Owner's Representative of any changes to proposed method of dewatering at least two weeks before enacting change.

.4 Upon completion of dewatering installations, submit a detailed plan of the dewatering system as constructed including test data and computations demonstrating that the system is capable of achieving the desired result.

1.4 POWER SUPPLY

.1 Provide all power and connections as required. Obtain power from construction power supply as specified in Section 1 09 00 – Temporary Utilities.

.2 Construction power supply as specified in Section 1 09 00 – Temporary Utilities is interruptible.

.3 Provide adequate, continuous back-up power for dewatering system.

.4 Pay for metering installation and cost of power supply.

1.5 DESIGN CRITERIA

.1 Design dewatering scheme to maintain the groundwater level at least 1000 mm below the underside of excavation required for all pipelines or structures under construction.

.2 Discharge dewatering system in accordance with Environmental Guidelines. Trench dewatering can be discharged at the surface provided it does not flow to the raw water ponds, private property, or directly into natural water body. Do not discharge to sanitary sewer. Ensure adequate erosion protection at discharge points and include sediment disposition control in dewatering process. Contractor will be responsible for restoring any damaged/impacted surface to the original condition.

.3 Discharge piping to be designed to allow for discharge redirection as directed by Owner's Representative, without affecting dewatering operations. Route piping to maintain unrestricted access to plant operations and other construction activities.

.4 Provide tap at point of dewatering discharge for sampling purposes.

2 Products

.1 Not Used

3 Execution

3.1 GENERAL

.1 Prior to commencement, survey and monitor adjacent structures.

.2 Level of groundwater beneath excavation must be measured by the installed piezometers.

3.2 DEWATERING

.1 Control groundwater in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation slopes, and will minimize damage to existing structures.

.2 Lower the water table in advance of excavation using wells, well points, or similar methods.

.3 Maintain the water level, as measured in piezometers, a minimum of 1000 mm below the prevailing excavation level for structure or pipeline under construction, unless otherwise noted.

.4 Dewatering must be managed to accommodate variations in groundwater levels resulting from tides, river levels, precipitation, and other influences to prevent flooding of excavations.

.5 Insulate or otherwise protect dewatering pipes and equipment from freezing.

.6 Keep excavations free of water at all times while work is in progress.

.7 Protect open excavations against flooding and protect side slopes from damage due to surface run-off and piping.

.8 Dispose of water in a manner not detrimental to public or private property, or any portion of work completed or under construction.

.9 At all times, operate the dewatering system in such a manner as to detect and guard against the danger caused by the possible discharge and accumulation of methane and other potentially explosive gases which may be present in the ground water during dewatering operations.

.10 Prior to terminating any dewatering operations, submit to Owner’s Representative means of flotation prevention for constructed structures.

.11 Prevent rapid recharge when terminating dewatering operations to prevent loosening of sub-base material.

4 Measurement and Payment

.1 Dewatering excavations during construction will be measured as a lump sum item. Payment shall be made on percent complete basis as determined by the Owner's Representative based on tendered price. The lump sum price shall include but not limited to the procurement, construction, operation, maintenance, and removal of equipment and temporary structures to permit workable conditions in all excavations.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials (ASTM)

.1 AASHTO-M-306-10, Standard Specifications for Grey Iron Castings

.2 ASTM C139, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.

.3 ASTM C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

.4 ASTM C478M, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections (Metric).

.2 Canadian Standards Association (CSA)

.1 CSA – A82.56M, Aggregate for Masonry Mortar

.2 CSA – A3000, Cementitious Materials Compendium

1.2 MATERIAL CERTIFICATION

.1 At least 4 weeks prior to commencing work, submit manufacturer's product data, shop drawings, and certification that materials meet requirements of this Section.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for manholes and catch basin structures and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by Owner’s Representative registered or licensed in Alberta, Canada.

.4 Submit certificate of compliance for precast cement type in accordance with Section 1 04 00 – Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect manholes and catch basin structures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

2 Products

2.1 MATERIALS

.1 Cast-In-Place Concrete:

.1 To Section 3 02 30 - Cast-in-Place Concrete.

.2 Cement: to CSA A3000 Type 50.

.2 Concrete reinforcement: to Section 3 02 20 - Concrete Reinforcement.

.3 Precast manhole sections: to ASTM C478M, circular or oval.

.1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation. Manhole bases are to be prefabricated complete with pipe stubs installed.

.4 Pre-cast catch basin section to ASTM C478M circular.

.5 All joints shall be sealed with rubber gaskets conforming to ASTM C443 and grouted inside and outside with non-shrink grout.

.6 Manhole bases are to be pre-finished, pre-benched manhole bases properly formed to suit the gravity sewer pipe. Make all sewer pipe connections watertight using watertight Duraseal or G-Loc joints or approved equivalent.

.7 Mortar:

.1 Aggregate: to CSA-A82.56M

.2 Cement: to CSA-A3000, Type 50

.8 Ladder rungs shall be standard safety type, aluminum forced to 6061-76 alloy having a minimum tensile strength of 200 MPa.

.1 Rungs to be safety pattern (drop step type).

.9 Adjusting rings: to ASTM C478M.

.10 Frames, gratings, covers to dimensions as indicated and following requirements:

.1 Metal gratings and covers to bear evenly on frames.

.1 A frame with grating or cover to constitute one unit.

.2 Assemble and mark unit components before shipment.

.2 Gray iron castings: to AASHTO-M-306-10.

.3 Castings to be coated with two applications of asphalt varnish or sand blasted or cleaned and ground to eliminate surface imperfections.

.4 Manhole frames and covers, as indicated on the drawings.

.5 Catchbasin frame and covers, as indicated on drawings.

.11 Drop manhole pipe to be same as sewer pipe. Each of the MH riser joints and openings should be waterproofed using a strip of Colphene 3000 c/w Elastocol Primer as supplied by Soprema Inc. or approved equal to minimize inflow and infiltration.

.12 The entire outer surface of all sanitary precast concrete manholes shall be coated with two (2) coats of an approved bitumastic coating. Coating shall be Koppers 300 M Epoxy or Pennsbury 32-B-4 Epoxy or Sealmastic 501 or approved equal. Not required for storm sewer structures.

.13 In areas where high water table is above the bottom of the manhole or underground concrete vault structures, the structure is to have both a concrete waterproofing admixture added to the mix design and a fully sealed exterior waterproofing membrane cover the full exterior including under the base slab. Shop drawings are to be provided to the Municipality for review and approval prior to installation. Buoyancy proofing may also be required. Not required for storm sewer structurers

3 Execution

3.1 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling.

.2 Review with Owner's Representative before installing manholes.

.3 Complete field density testing around manholes and catchbasins in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling,

3.2 CONCRETE WORK

.1 Cast-in-place concrete work in accordance with Section 3 02 30 - Cast-in-Place Concrete.

.2 Place concrete reinforcement in accordance with Section 3 02 20 - Concrete Reinforcement.

.3 Position metal inserts in accordance with dimensions and details indicated.

3.3 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses.

.1 Maximum of three units behind point of pipe laying will be allowed.

.3 Dewater excavation and remove soft and foreign material before placing concrete base.

.4 Cast bottom slabs directly on undistributed ground.

.5 Set precast concrete base on 50 mm minimum of washed rock.

.6 Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.

.2 Make each successive joint watertight with approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination thereof.

.3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.4 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.

.7 For sewers:

.1 Place stub outlets and bulkheads at elevations and in positions indicated.

.2 Bench to provide a smooth channel as shown on the details.

.8 Compact granular backfill in accordance with Section 3 07 30 – Granular Base.

.9 Place unshrinkable backfill in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling.

.10 Installing units in existing systems:

.1 Where new unit is to be installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.

.2 Make joints water tight between new unit and existing pipe.

.3 Where deemed expedient to maintain service around existing pipes, and when systems constructed under this project are ready to be put in operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.11 Install aluminum safety platforms in manholes having a depth of 6.0 m or greater, as indicated.

.12 Set frame and cover to required elevation on no more than two courses of brick. Make brick joints and join brick to frame with cement mortar, parge and make smooth and watertight.

.13 Place frame and cover on top section to elevation indicated.

.1 If adjustment required use concrete ring.

.14 Sanitary manholes are not to remain uncovered, even if at incomplete height. Waterproof covers are to be installed at the end of each work day. Waterproof covers are to be installed during the work if rain is forecast.

.15 Clean units of debris and foreign materials.

.1 Remove fins and sharp projections.

.2 Prevent debris from entering system.

3.4 QUALITY CONTROL

.1 Leakage Test:

.1 Install watertight plugs or seals on inlets and outlets of each new sanitary sewer manhole and fill manhole with water.

.2 Leakage not to exceed 0.3% of volume of manhole/hour.

.3 If permissible leakage is exceeded, correct defects. Repeat until acceptable to Owner's Representative.

.4 Owner's Representative will issue a test certificate for each manhole passing test.

4 Measurement and Payment

4.1 EXCAVATION AND BACKFILLING

.1 No separate payment will be made for excavation and backfilling for manhole and catch basin installations.

4.2 MANHOLES

.1 Manholes will be measured in vertical metres, as measured from the top of the frame to the lowest invert elevation.

.2 The unit price for manholes will include the supply of all materials, equipment, and labour including supply and installation of precast manhole sections, supply and installation of cast-in-place concrete, base structure, pipe stub outlets, benching, grouting, sealing joints, and all other incidental work required to adhere to the requirements of this Section.

4.3 CATCH BASIN MANHOLES

.1 Manholes will be measured in vertical metres, as measured from the top of the frame to the bottom of the sump.

.2 The unit price for catch basin manholes will include the supply of all materials, equipment, and labour including supply and installation of precast manhole sections, supply and installation of cast-in-place concrete, base structure, pipe stub outlets, benching, grouting, sealing joints, and all other incidental work required to adhere to the requirements of this Section.

4.4 CATCH BASINS

.1 Catch basins will be measured in numbers of units installed.

.2 The unit price for catch basins will include the supply of all materials, equipment, and labour including supply and installation of precast catch basin sections, supply and installation of cast-in-place concrete, base structure, pipe stub outlets, grouting, sealing joints, and all other incidental work required to adhere to the requirements of this Section.

4.5 MANHOLE FRAMES AND COVERS

.1 Manhole frames and covers will be measured in numbers of units installed.

.2 The unit price for frames and covers will include the supply of the frame and cover in addition to all equipment and labour to install the frame and cover.

4.6 CATCH BASIN FRAMES AND GRATES

.1 Catch basin frames and grates will be measured in numbers of units installed.

.2 The unit price for frames and grates will include the supply of the frame and grate in addition to all equipment and labour to install the frame and cover.

END OF SECTION

1 General

This Section specifies requirements for supplying and installing catch basin leads.

2 Products

2.1 PLASTIC PIPE

.1 PVC pipe and fittings to meet CSA B182.4, ASTM F794 and Uni-bell Uni-B-9.

.2 Minimum pipe stiffness to be 320 kPa as measured in accordance with ASTM D2412.

.3 Gaskets to be designed for specific PVC pipe and shall meet ASTM F477.

.4 Pipe diameter to be 200 mm or greater.

.5 Any colour except blue.

2.2 CORRUGATED METAL PIPE

.1 Not an approved catch basin lead material

3 Execution

3.1 TRENCHING, BEDDING AND BACKFILL

.1 Trenching, bedding and backfill to Section 2 01 00 – Excavation, Trenching and Backfilling.

.2 Trench line and grade as established by the Owner’s Representative.

.3 Do not backfill until pipe grade and alignment inspected by the Owner’s Representative.

.4 Complete field density testing around manholes and catch basins in accordance with Section 2 01 00 – Excavation, Trenching and Backfilling.

3.2 LAYING CATCH BASIN LEAD

.1 Commence laying at manhole.

.2 Minimum slope of 2%.

.3 Lay and join pipe in accordance with manufacturer's recommendations.

.4 Ensure bottom of pipe is in contact with shaped bed throughout its length.

.5 Do not allow water to flow through pipes during construction except as permitted by Owner's Representative.

3.3 JOINTS

.1 Install rubber gaskets and couplers in accordance with manufacturer's instructions.

3.4 CONNECTION TO CATCH BASINS AND MANHOLES

.1 Break out opening to suit pipe diameter.

.2 Cut pipe to conform to inside wall of manhole or catch basin.

.3 Grout pipe in place.

.4 Encase first 0.5 m of pipe in concrete. Thickness of encasement to be one half pipe diameter or 150 mm, whichever is greater.

4 Measurement and Payment

4.1 CATCH BASIN LEADS

.1 Catch basin leads will be measured horizontally from centre line of manhole to centre line of catch basin in metres for each size and type of pipe supplied and installed.

.2 Unit price bid shall be full compensation for dewatering, supply and installation of catch basin leads including pipe laying and jointing.

.3 No separate payment to be made for connections to manholes and catch basin.

END OF SECTION

1 GENERAL

This Section specifies requirements for adjusting existing manholes, catch basins, hydrants and water valves.

2 Products

2.1 MATERIALS

.1 Precast manhole section to ASTM C478 circular. Top sections eccentric cone or flat slab top type with opening offset.

.2 Precast catch basin sections to ASTM C139, ASTM C478.

.3 Mortar

.1 Aggregate to CAN3-A82.56.

.2 Cement to CSA-A3000, Cementitious Materials Compendium, sulfate resistant, Type HS.

.4 Ladder rungs 20 mm diameter Galvanized preformed steel or aluminum rungs. Rungs to be safety pattern (drop step type).

.5 Adjusting rings to ASTM C478.

.6 Concrete brick to CAN3-A165.2.

.7 All exterior hydrant extension bolts and nuts to be T304 stainless steel.

3 Execution

3.1 MANHOLES AND CATCH BASINS

.1 Remove existing grates and frames; store for re-use at locations designated by Owner’s Representative, if required.

.2 Sectional units:

.1 Raise or lower straight walled sectional units by removing slab top and adding or removing precast sections as required.

.2 Raise or lower tapered units by removing cone section, adding, removing or substituting riser sections to obtain required elevation, then replace cone section with slab top.

.3 When amount of raise is less than 300 mm use standard manhole brick or grade rings.

.3 Monolithic units:

.1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with mortared brick course for 150 mm or less alteration.

.2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.

.3 When monolithic units with tapered upper section are to be lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.

.4 Install additional manhole ladder rungs in adjusted portion of units as required.

.5 Re-use existing gratings and frames.

.6 Re-set gratings and frames to required elevation on no more than three concrete rings and no more than one course of brick. Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.

.7 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

.4 Frame and Cover:

.1 Recess catch basin frame and cover 10 mm below gutter elevation and 10 mm behind the face of curb.

.2 Recess manhole frame and cover 5 mm below finished asphalt surface elevation or 19 mm to 25 mm below finished gravel lane surface. If adjustments required, remove or add concrete rings, not to exceed allowable.

.3 Join brick course to frame with cement mortar, parge and make smooth and watertight using bituminous gasket (Rub-R-Nec).

.5 Install additional ladder rungs in manholes as directed by Owner’s Representative.

3.2 WATER VALVES

.1 Excavate and expose adjustable portion of water valve casing.

.2 Adjust water valve casing to design elevation.

.3 Recess top of water valve 5 mm below finished asphalt surface elevation or to a maximum of 25 mm below finished gravel lane surface.

.4 Backfill excavation. Ensure water valve casing will not settle.

.5 Operate valve in presence of Owner’s Representative to verify it is operational.

3.3 HYDRANTS

.1 Excavate and expose top extension section of fire hydrant.

.2 Remove existing extension section and hydrant rod and replace with appropriate unit to place hydrant within 25 mm of design elevation.

.3 Complete hydrant flow test in accordance with Section 2 03 00 – Water Mains.

4 Measurement and Payment

4.1 ADJUSTMENT OF MANHOLES, CATCH BASINS, HYDRANTS, AND WATER VALVES

.1 Adjustment of manholes, catch basins, frames and covers, hydrants, and water valves to be measured by number adjusted.

.2 The unit price for adjustment of manholes, catch basins, hydrants, and water valves shall include sawcutting, removal of asphalt, removal of materials as needed to expose the work area, supply of all grade rings and materials, patching of the structure surrounding the work area to match existing conditions, and all labour, materials, and equipment required to make the adjustment.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA B300, Hypochlorites

.2 ANSI/AWWA B301, Liquid Chlorine

.3 ANSI/AWWA C110, Ductile-Iron and Gray-Iron Fittings.

.4 ANSI/AWWA C153, Ductile-Iron Compact Fittings

.5 ANSI/AWWA C500, Metal-Seated Gate Valves for Water Supply Service.

.6 ANSI/AWWA C502, Dry Barrel Fire Hydrants

.7 ANSI/AWWA C509, Resilient-Seated Gate Valves for Water Supply Service.

.8 ANSI/AWWA C512, Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.

.9 ANSI/AWWA C515, Reduced-Wall, Resilient Seated Gate Valves for Water Supply Service.

.10 ANSI/AWWA C550, Protective Interior Coatings for Valves and Hydrants.

.11 ANSI/AWWA C600, Installation of Ductile-Iron Mains and Their Appurtenances.

.12 ANSI/AWWA C604, Installation of Buried Steel Water Pipe – 4 In. (100 mm) and Larger.

.13 ANSI/AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

.14 ANSI/AWWA C651, Disinfecting Water Mains.

.15 ANSI/AWWA C800, Underground Service Line Valves and Fittings.

.16 ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 60 In. (100 mm – 1,500 mm).

.17 ANSI/AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for Water Service.

.18 ANSI/AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 In.(100 mm) through 65 In. (1,600mm), for Water Distribution and Transmission.

.19 ANSI/AWWA C907, Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. through 12 In. (100 mm through 300 mm) for Water, Wastewater, and Reclaimed Water Service.

.2 American Water Works Association (AWWA)/Manual of Practice

.1 AWWA M11, Steel Pipe – A Guide for Design and Installation

.2 AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.

.3 AWWA M55, PE Pipe – Design and Installation

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.59, Alkyd Exterior Glass Enamel.

.2 CGSB 41-GP-25M, Pipe, Polyethylene, for the Transport of Liquids.

.4 CSA International

.1 CSA – A82.56M, Aggregate for Masonry Mortar

.2 CSA – A3000, Cementitious Materials Compendium

.3 CAN/CSA-B137 Series, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

.4 CAN/CSA-B137.3, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

.5 CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables

.6 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

.7 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.8 CSA-Z245.12, Steel Flanges

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 1 04 00 – Submittal Procedures.

.1 Shop drawings to include:

.1 The length of all line pipe, standard pipe and all special sections and fittings;

.2 A sequential and identifying Mark number or letter;

.3 All dimensions required for fabrication;

.4 All material specifications;

.5 Material thickness, reinforcement, tolerances, and welding details;

.6 Any variation to the coating and lining specified.

.2 Submit samples in accordance with Section 1 04 00 - Submittal Procedures.

.3 Inform Owner’s Representative of proposed source of bedding materials and provide access for sampling at least 2 weeks prior to commencing work.

.4 Submit manufacturer's MSDS sheets for the type of chlorination and de-chlorination agents to be used for the disinfection and de-chlorination process.

.5 Submit a Water Main Flushing, Testing and Disinfecting Plan (FTD Plan), for the Owner's Representative's review and documentation two (2) weeks after project award.

.6 Provide data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 1 11 00 – Closeout Procedures.

1.3 MATERIAL CERTIFICATION

.1 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least 4 weeks prior to commencing work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions to Owner's Representative for approval and adhere to interruption schedule as approved by Owner's Representative.

.3 Notify Owner's Representative minimum of 48 h in advance of any interruption in service.

.4 Co-ordinate service interruption with the respective municipal authority.

.5 Do not interrupt water service for more than 3 h and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.

.6 Notify the Municipality and ensure that Emergency Services are notified of any planned or accidental interruption of water supply to hydrants.

.7 Advise local police department of anticipated interference with movement of traffic.

2 Products

2.1 POTABLE WATER COMPLIANCE

.1 All materials which will be in contact with potable water, once placed in service, must comply with NSF 61.

2.2 PIPE, JOINTS AND FITTINGS

.1 Water Pipe

.1 Polyvinyl Chloride (PVC) – AWWA C900 (100mm to 300mm diameter)

.1 Gasket bell end, cast iron outside diameter (CIOD) certified to CSA B137.3 Rigid Poly (Vinyl Chloride) (PVC)

.2 Joint lubricants must be certified for potable water use to NSF 61.

.3 An affidavit of compliance to the AWWA C900 standard to be supplied upon request.

.4 Fabricated PVC Fittings: conform to CSA B137.3, fabricated from AWWA C900 bonded and overwrapped with fibreglass reinforced polyester.

.5 PVC fitting (moulded): conform to AWWA C907 and certified to CSA B137.2 (Class 150).

.6 All joints and fittings to be compatible with design, test and surge pressures of the adjoining pipe:

.2 Polyvinyl Chloride (PVC) – AWWA C905 (350mm to 900mm diameter)

.1 Gasket bell end, cast iron outside diameter (CIOD) certified to CSA B137.3 Rigid Poly (Vinyl Chloride) (PVC)

.2 Joint lubricants must be certified for potable water use to NSF 61.

.3 An affidavit of compliance to the AWWA C900 standard to be supplied upon request.

.4 Fabricated PVC Fittings: conform to CSA B137.3, fabricated from AWWA C905 bonded and overwrapped with fibreglass reinforced polyester.

.5 PVC fitting (moulded): conform to AWWA C907 and certified to CSA B137.2 (Class 150).

.6 Ductile Iron Fittings: to ANSI/AWWA C153/A21.53, C110/A21.10 for pipe diameters larger than 300mm

.7 All joints and fittings to be compatible with design, test and surge pressures of the adjoining pipe:

.3 High Density Polyethylene (HDPE) – AWWA C906

.1 AWWA C906, DR 11

.2 Marked with continuous blue stripe

.3 100mm through 1,650mm, CSA-B137.1 Polyethylene pipe, tubing, and fittings for cold-water pressure services; to AWWA C901 for pipe 13 mm through 76 mm.

.4 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D 2657.

.5 Ductile iron fittings with flanged ends: to AWWA C110/A21.10 for pipe size above 100 mm.

.6 Polyethylene fittings: to CAN/CSA B137.1 or AWWA C901. Ductile iron backup flange to Class 150, ANSI B16.1/B16.5 dimensional standards with stainless steel bolts and nuts, with neoprene or red rubber gasket.

.7 Joints: thermal butt fusion, electro fusion, approved fusion methods provided by qualified personnel.

.8 All joints and fittings to be compatible with design, test and surge pressures of the adjoining pipe:

.2 Restrained Joints

.1 Mechanically restrain all connections of pipe, bends, fittings and valves as indicated on the drawings. Restrainers will have UL and FM certification. All joint restraints to be wrapped in petrolatum tape and paste.

.3 Pipe to be compatible with specified mechanical joint fittings and valves without the use of special adaptors.

2.3 FLANGES/COUPLERS

.1 Manufacture fittings and flanges in accordance with CSA Z245.12, Category 1 classification and the following supplementary data:

.1 Diameter equal to that of pipe being used.

.2 Grade 290 steel or greater.

.3 Pressure rating: ANSI Class 250.

.4 Design pressure: 1380 kPa.

.5 Surge pressure: 40% greater than design pressure.

.2 Fittings:

.1 Unless specifically called for, use threaded connection for piping 65 mm and smaller.

.2 Unless specifically noted otherwise, use butt-weld connection for piping 75 mm and larger.

.3 Welded Fittings 75 mm to 750 mm Inclusive: Seamless carbon steel, butt-weld type, Grade NPB. Standard weight or extra strength as required to achieve at least the same working pressure rating as the pipe to which fittings are attached. Do not use fabricated fittings.

.4 Welded Fittings 800 mm to 1200 mm Inclusive: Carbon steel, butt-weld type, Grade WPB and conforming to ASTM A234. Fittings to be standard weight or extra strength as required to achieve at least the same working pressure rating as the pipe to which the fittings are attached.

.5 Fabricated Welded Fittings 800 mm to 1200 mm Inclusive: Fabricated welded fittings may be used where specifically indicated. Fabricated fittings to be produced from the same pipe as specified for steel pipe, 650 mm to 1200 mm inclusive, and to the dimensions of AWWA C208, latest edition. Reinforce fabricated fittings per the requirements of AWWA M11 to achieve a working pressure rating at least equal to the pressure rating of the pipe itself.

.3 Flanges:

.1 75 mm to 600 mm Inclusive: Forged carbon steel, weld neck type, conforming to ANSI A181, Grade I for Class 150 lb and Class 300 lb. Use Class 300 lb flat-faced flange only when mating to a Class 250 cast iron valve.

.2 650 mm to 1200 mm Inclusive: Forged carbon steel, weld neck and slip-on type, Class 250 lb to ANSI Bl6b, material to ASTM A105. Use slip-on flanges only where specifically indicated. Use a flat-faced flange when mating to a 250 lb cast iron valve. Confirm that flange bores and bolting patterns match the valve and pipe to which it is mated.

.4 Flanged Compression Sleeve Couplings - F/C Couplings:

.1 750 mm to 1200 mm Inclusive: 250 lb ANSI forged steel flange with a steel sleeve and follower ring. Sleeve length not to exceed 140 mm. Working pressure rating of at least 1750 kPa (250 psi) for the entire assembly. The design of the couplings is to be such that they allow for direct flange to pipe harnessing as detailed on the drawings. Line couplings internally with an epoxy coating as per AWWA C210. If possible, design adaptors to allow follower bolt removal toward the flange of the adaptor.

2.4 NUTS AND BOLTS

.1 Direct buried, in manholes or submerged service - stainless steel bolts and nuts on direct buried or submerged applications conforming to ASTM A193 Grade B8 or B8M.

2.5 CATHODIC PROTECTION

.1 To provide electrical continuity in the line, provide all flanges, couplings, sleeves, fittings, valves and hydrants with two #4 AWG insulated copper jumper wires, cadwelded to the pipe on each side of the joint or valve and or to the coupler sleeve.

.2 Coating for thermite welds: Royston Roskote A-51 mastic or equal.

.3 Water Services:

.1 All copper services 50 mm diameter and smaller shall have a 5.5 kg zinc anode attached to the copper service pipe.
.2 The zinc anode wire shall be clamped to the copper service within 0.54 metres of the main stop within the main roadway:
.3 An all-brass clamp shall be used.
.4 Anode installation as detailed on drawings.

.4 Buried Steel Pipe and Fittings:

.1 All steel pipe and fittings require cathodic protection with high potential magnesium anodes.

.2 A soil resistivity analysis shall be conducted along length of the pipeline to calculate the weight and spacing of anodes.

.3 A cathodic protection report shall be provided to the Municipality along with the detailed design.

.4 Cathodic protection design by corrosion specialist

2.6 PIPE CUTTERS

.1 Ensure that cutting procedures are complementary with the type of interior lining materials being used. Generally, flame cutters are considered acceptable for use on unlined, epoxy lined or enamel lined pipe.

2.7 VALVES AND VALVE BOXES

.1 Gate Valves (75 mm to 300 mm diameter)

.1 AWWA C509 with working pressure rating of 250 psi.

.2 Iron body, resilient seated, non-rising bronze stem, flanged ends, epoxy coating10-14 mil inside and outside to AWWA C550, opens counter clockwise, full port, O-ring stem seals.

.3 Stainless steel nuts and bolts to ANSI 304.

.4 Cathodically protected with 5.5 kg zinc anode with cad weld or mechanical connection to the valve body.

.5 Install of gate valve as per Standard Detail 7-100.

.2 Gate Valves (350 mm diameter and larger)

.1 AWWA C515 with working pressure rating of 250 psi.

.2 Iron body, resilient seated, non-rising bronze stem, flanged or mechanical joint end, internal bypass, stainless steel shaft, epoxy coating10-14 mil inside and outside to AWWA C550, opens counter clockwise, full port, O-ring stem seals.

.3 Internal bypass is optional if an external bypass is used.

.4 Stainless steel nuts and bolts to ANSI 304.

.5 Cathodically protected with 5.5 kg zinc anode with cad weld or mechanical connection to the valve body.

.6 Install of gate valve as per Standard Detail 7-100.

.3 Cast iron valve boxes:

.1 Epoxy coated two-piece cast iron sliding type adjustable over a minimum of 450 mm, 50 mm top operating nut with stone catcher flange, complete with valve operating extension rod, 25 x 25 mm cross section, of such length that when set on valve operating nut top of rod will not be more than 300 mm below cover. Base to be large round type with minimum diameter of 184 mm. Top of box to be marked "WATER" with cored handholes.

.2 Depth of bury: 3.5 m to top of pipe (min).

.3 Type: Norwood Type A or equivalent.

.4 PVC valve boxes are not approved.

.4 Air and vacuum release valves:

.1 Conform to AWWA C512 - 13 mm through 150 mm air-release valves and 13 mm though 500 mm air/vacuum and combination air valves having gray cast iron or ductile iron bodies and covering with maximum working pressure of 2,070 kPa.

.2 Body and cover shall be of gray cast iron (ASTM A126, Class B or ASTM A48, Class 35) or ductile iron (ASTM A536, Grade 65-45-12) and shall have threaded or flanged connections as required.

.3 Flanged ends dimensions and drilling shall conform to ANSI/ASME B16.1, Class 125 or Class 250 except all flanges shall be flat faced unless otherwise specified.

.4 Threaded end connections shall conform to the specifications for tapered pipe threads for general use, National Pipe Threads (NPT) per ANSI/ASME B1.20.1.

.5 Floats for valves with inlet sizes less than 100 mm shall be capable of withstanding a collapse pressure of 6,900 kPa. For 100 mm and larger, shall be capable of withstanding collapse pressure of 5,180 kPa.

.6 Gaskets shall be made of rubber composition of paper that is free of asbestos or corrosive ingredients. O-rings or the suitable elastomeric seals may be used for gaskets. O-rings shall be compounded to meet ASTM D2000 and has physical properties suitable for the application.

.7 An air release valve and an air/vacuum valve assembled with inter-connecting pipes shall have pipe fittings of sufficient size to prevent clogging and entrapment of foreign materials. The piping between the air/vacuum valve and the air-release valve be installed to allow air to rise to the air-release inlet. A shutoff valve isolating the two valves shall be installed.

.8 Inlet and outlet ports for air/vacuum valves and combination air valves shall be sized to ensure that the minimum flow area of each port shall be equal to or greater than the flow area of a circle of diameter equal to the nominal valve size.

.9 Elastomers shall:

.1 be resistant to microbial attack, copper poisoning, and ozone attack.

.2 contain no more than 8 ppm of copper ion and shall include copper inhibitors to prevent copper degradation of the rubber material.

.3 be capable of withstanding an ozone-resistance where tested in accordance with ASTM D1149.

.4 have a maximum compression set valve of 18 percent when tested in accordance with ASTM D395, Method B, for 22 h at 71□C.

.5 be free of vegetable oils, vegetable soil derivatives, animal fats and animal oils.

.6 contain no more than 1.5 parts wax per 100 parts of rubber hydrocarbon and shall have less than a 2 percent volume increase when tested in accordance with ANSI/ASTM D471 after being immersed in distilled water between 23°C and 1°C for 70 hr. Reclaimed rubber shall not be used.

.5 Underground type indicator valve where indicated. Indicator post to accurately indicate valve open or closed. Valve to be protected in corrosive soil as indicated

2.8 VALVE CHAMBERS

.1 Concrete and reinforcing steel: to Section 3 02 30 - Cast-in-Place Concrete and Section 3 02 20 - Concrete Reinforcement.

.2 Precast concrete sections to ASTM C 478M. Ladder rungs to be cast integral with unit; field installation not permitted. Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation. Monolithic bases to be approved by Owner’s Representative and set on concrete slabs cast in place.

.3 Valve chamber frames and covers: gray iron castings, minimum tensile strength 200 MPa, with two coats, shop applied, approved asphalt coating. Design and dimensions to be as indicated. Cover to be marked "WATER". Manhole frame and covers: type as indicated on drawings. All joints to be watertight and sealed with cement mortar on interior and exterior of manhole.

.4 To prevent surface water infiltration, chambers and manholes shall be designed and backfilled to slope away from the rim.

.5 To minimize below grade infiltration the entire outer surface of all water chambers or manholes shall be coated with two (2) coats of an approved bitumastic coating. Coating shall be Koppers 300 M Epoxy or Pennsbury 32-B-4 Epoxy or Sealmastic 501 or approved equal.

.6 In areas where high water table is known to be above the bottom of the structure based on the geotechnical report, the structure is to have both a concrete waterproofing admixture added to the mix design and a fully sealed exterior waterproofing membrane cover the full exterior including under the base slab. Shop drawings are to be provided to the Municipality for review and approval prior to installation. Buoyancy proofing may also be required, as well as fastening the manhole/vault joints together to prevent lifting.

.7 Jointing materials:

- .1 Manufacturer's rubber ring gaskets.
- .2 Mastic joint filler.
- .3 Cement mortar.
- .4 Combination of above types.

.8 Mortar: aggregate to CSA A82.56, cement to CAN/CSA-A3000.

.9 Ladder rungs for valve chambers: 20 mm diameter deformed rail steel bars to CAN/CSA-G30.18, hot-dipped galvanized after fabrication to CAN/CSA-G164. Rungs to be safety pattern.

.10 Adjusting rings: to ASTM C478M

2.9 SERVICE CONNECTIONS

.1 Service line valves and fittings to conform to ANSI/AWWA C800.

.2 Copper tubing (20mm to 50mm diameter) to ASTM B 88M annealed with thaw wire (insulated).

.1 Approved products:

.1 Wolverine Type K “Soft” – Third party certified to ASTM B88M

.2 Cerro Type K “Soft” - Third party certified to ASTM B88M

.3 Halstead Type K “Soft” - Third party certified to ASTM B88M

.3 Couplings to be brass compression type.

.4 Copper tubing joints: Compression type suitable to 1MPa working pressure.

.5 Service saddles

.1 Double strapped, rated to 150 psi working pressure.

.2 Approved products:

.1 Robar 2706 cast bronze (100mm to 600mm)

.2 Robar 2626 stainless steel (75mm to 450mm)

.6 Main stops

.1 Brass Corporation stops: Red Brass to ASTM B 62

.2 Approved products:

.1 Cambridge Brass 301-A3H3, Compression end (20mm)

.2 Cambridge Brass 301-A4H4, Compression end (25mm)

.3 Cambridge Brass 301-A6H6, Compression end (40mm)

.4 Cambridge Brass 301-A3C3, Flared end (20mm)

.5 Cambridge Brass 301-A4C4, Flared end (25mm)

.6 Cambridge Brass 301-A6C6, Flared end (40mm)

.7 Cambridge Brass 301-A7C7, Flared end (50mm)

.8 Mueller B-25000, Flared end (20mm, 25mm, 40mm, 50mm)

.9 Mueller B-25008, Compression end (20mm, 25mm, 40mm, 50mm)

.7 Curb stops

.1 Curb Stop will be copper to copper invert and key stop and drain. Curb Stops to have adjustable case iron box with stem to suit depth of bury. Top of cast iron box marked “water”.

.2 Approved products:

.1 Cambridge Brass 202-H3H3, Compression ends (20mm)

.2 Cambridge Brass 202-H4H4, Compression ends (25mm)

.3 Cambridge Brass 202-H6H6, Compression ends (40mm)

.4 Cambridge Brass 202-H7H7, Compression ends (50mm)

.5 Cambridge Brass 202-C3C3, Flared ends (20mm)

.6 Cambridge Brass 202-C4C4, Flared ends (25mm)

.7 Cambridge Brass 202-C6C6, Flared ends (40mm)

.8 Cambridge Brass 202-C7C7, Flared ends (50mm)

.9 Mueller H-15204, Flared ends (20mm, 25mm, 40mm, 50mm)

.10 Mueller H-15209, Compression ends (20mm, 25mm, 40mm, 50mm)

.8 PVC pipe (for services 100mm and larger) – AWWA C 900

.1 Bronze Type Service Clamps: for PVC pipe service connections. Service clamps to be of Strap type with confined O ring seal cemented in place. Clamps to be tapped with threads to ANSI/AWWA C800.

.9 Tee connections to be fabricated of the same material as adjoining pipes.

2.10 HYDRANTS

.1 Hydrants to conform to AWWA C502

.2 Approved products:

.1 Canada Valve-Darling, Century, 150mm, AWWA C502

.2 Mueller, Modern Centurion, 150mm, AWWA C502

.3 Clow, M-67 Brigadier, 150mm, AWWA C502

.4 American Flow Control, American Valve Hydrant, 150mm, AWWA C502

.5 AVK, Series 27, 150mm

.3 Hydrants are to be complete with breakaway flange and a 600mm spool piece.

.4 The minimum hydrant connection size shall be a 150mm hub end.

.5 The minimum cover shall be 3.5 m.

.6 Drain outlets shall be plugged.

.7 Hydrants shall have two 63.5 mm hose connections and one 114 mm pumper connection as presently used in the community.

.8 Hydrant main spindles shall turn to the left (counter clockwise) to open.

.9 A gate valve shall be provided on each connection between a hydrant and main.

.10 Hydrants shall be alkyd exterior glass enamel painted to CAN/CGSB-1.59.

.1 Municipal hydrants are to be red in colour, and private hydrants yellow in colour.

.11 All bolts and nuts must be stainless steel, type 304 and wrapped with petrolatum tape.

.12 Hydrants shall be cathodically protected with 5.5kg zinc sacrificial anode.

2.11 PIPE ZONE AND SURROUND MATERIAL

.1 Bedding material shall be Class B sand, conforming to the standard details and the gradation specified in Section 3 04 00 – Aggregate Materials.

.2 Place Pipe Zone and Surround Material to Section 3 04 00 – Aggregate Materials and Section 2 01 00 – Excavating, Trenching and Backfilling

.3 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 3 02 30 - Cast-in-Place Concrete.

2.12 BACKFILL MATERIAL

.1 Backfill Material and Compaction to Section 3 04 00 – Aggregate Materials.

2.13 ZINC ANODES (FOR BURIED VALVES, METAL FITTINGS, AND COUPLINGS)

.1 Zinc anodes: to ASTM B418 Type II with the following composition:

.1	Aluminum	0.005%
.2	Cadmium	0.003%
.3	Iron	0.0014%
.4	Copper	0.002%
.5	Zinc	Remainder

.2 Lead Wire No.: 10 AWG, 3 m long to CSA C22-2 No.38.

.3 Minimum size; 5.5 kg.

.4 Conductivity strip used for bonding across couplings, valves, etc. shall be #4 AWG, stranded copper conforming for CSA C22-2 No.38.

2.14 TRACER WIRE

.1 Tracer wire is to be installed in the trench on top of all watermains.

.2 Tracer wire to be 12-gauge copper clad steel, HDPE insulated rated for direct bury, white in colour.

.3 Tracer wire is to be terminated in valve casings, or in flush mounted Tracer Wire Access Box, with minimum 500 mm excess wire inside the box. All termination points must be properly grounded by use of a drive-in magnesium grounding anode rod.

2.15 CORROSION PROTECTION

.1 In addition to anode protection and provision of test stations and conductivity strips, all buried nuts, bolts, transition couplings, restrainers, and metal fittings to be coated with petrolatum tape.

.2 Any alternate corrosion protection methods are to be approved by the Owner's Representative.

2.16 CHLORINATION AND DE-CHLORINATION AGENTS

.1 Calcium hypochlorite to AWWA B300 (Chlorination).

.2 Sodium hypochlorite to AWWA B301 (Chlorination).

.3 Ascorbic acid (Vitamin C) to ANSI/AWWA C651 (De-Chlorination).

3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects to approval of Owner's Representative. Remove defective materials from site.

3.2 TRENCHING

.1 Complete trenching work in accordance with Section 2 01 00 - Excavating, Trenching and Backfilling.

.2 Trench depth to provide cover over pipe of not less than 3.5 m from finished grade to top of pipe unless otherwise specified on design drawings.

.3 Trench alignment and depth require Owner's Representative approval prior to placing bedding material and pipe.

.4 Do not backfill trenches until installed, work has been checked and accepted by Owner's Representative.

.5 Allowable tolerances in alignment and grade as follows:

.1 Grade: ±20 mm

.2 Alignment: ±50 mm

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete work in accordance with Section 3 02 30 - Cast-in-Place Concrete. Place concrete to details as indicated or as directed by Owner's Representative.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 h after placing.

3.4 PIPE ZONE MATERIAL

.1 Place pipe zone material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated. Mechanical tamper plus width of trench to allow usage plus trench support. See Section 3 04 00 – Aggregate Materials and Section 2 01 00 Excavating, Trenching and Backfilling.

3.5 PVC PIPE INSTALLATION

.1 Pipe installation: to AWWA C605 for PVC pipe.

.2 Bevel or taper ends of PVC pipe to match fittings.

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

.4 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 differential settlement after installation.

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

.7 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.

.8 Position and join pipes with equipment and methods approved by Owner's Representative. Do not use excavating equipment to force pipe sections together.

.9 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.10 Align pipes carefully before jointing.

.11 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.12 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.

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

.14 Minimize deflection after joint has been made.

.15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Owner's Representative.

.17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.19 Do not lay pipe on frozen bedding.

.20 Protect valves and appurtenances from freezing.

.21 Upon completion of pipe laying and after Owner's Representative has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed by Owner's Representative.

.22 Hand place pipe zone material in uniform layers not exceeding 150 mm thick to minimum 300 mm over top of pipe. Do not dump material directly on top of pipe.

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

.2 Compact each layer to Section 3 04 00 - Aggregate Materials and Section 2 01 00 – Excavating, Trenching and Backfilling.

.23 Backfill remainder of trench.

3.6 DUCTILE IRON PIPE INSTALLATION

.1 Pipe installation: to AWWA C600 for Ductile Iron pipe.

.2 Join pipes in accordance with AWWA C600 for ductile iron pipe.

.3 Clean pipe and remove excess coating from pipe ends.

.4 Cut pipes where necessary to fit valves and fittings. Make cuts in accordance with Manufacturer's recommendations.

.5 Lower pipe in the trench using proper equipment, tools, and sling to protect pipe's coating. Lay pipes on prepared bed, true to line and grade.

.6 Centre the pipe in the trench with the bell and facing in the direction of the laying operations.

.7 Insert the gasket in the groove of the bell end.

.8 Apply a film of lubricant in the bell and spigot end of pipe.

.9 Push pipe in. Do not use excessive force.

.10 After joint is installed, deflect pipe as required. Do not exceed maximum permissible deflection as recommended by AWWA C600.

.11 Cadweld the electrical conductance, two per joint, at 11 o'clock and 1 o'clock position.

.12 Shrink wrap or double polyken tape the completed joint to ensure continuous and fully protected pipe joint. Complete each joint before laying next length of pipe.

.13 When stoppage of work occurs, cover open ends of installed pipe.

.14 Place pipe zone material. Do not dump material directly on top of pipe. Place material simultaneously on each side of the pipe to prevent lateral displacement.

3.7 POLYETHYLENE PIPE (HDPE) INSTALLATION

.1 Pipe installation: to AWWA M55.

.2 Polyethylene Pipe shall be joined by the thermal butt-fusion method in accordance with ASTM D2657 and in accordance with the pipe manufacturer's recommended procedure for jointing the pipe. Pipe or fittings joined by any form of fusion method can only be performed by technicians certified by the pipe manufacturer. Deflections at joints shall not be accepted unless they form part of a deflection fitting made on site.

.3 Remove all cuttings from the interior of the pipe before fusing.

.4 Joints between pipe sections shall be smooth on the inside and internal projection beads shall not be greater than 4 mm. The tensile strength at yield of the butt-fusion joints shall not be less than the pipe. All joints shall be logged. The log on each joint shall include the name of the certified operator, time, date, diameter, wall thickness, heating plate, temperature, fusing time and cool down time. The operator shall immediately report to the Owner's Representative any joint that fails.

.5 Whenever practicable the jointing shall be carried out at ground elevation and the jointed pipe subsequently lowered into the trench.

.6 The open end of the pipe in the trench shall be suitably covered to prevent entrance of trench water and other material during periods when pipe is not being installed.

.7 Precaution shall be taken to ensure that displacement of the pipe in the trench does not occur through soil displacement or flotation due to the presence of trench water. Pipe that has been displaced shall be removed from the trench and re-laid.

.8 No pipe shall be lowered into a ditch until all rocks, clods and debris have been removed.

.9 Whenever sheeting is used to control unstable trench conditions, it shall be left in place and before backfilling, the sheeting shall be cut off 1.5 metres below ground level. The sheeting may be removed after laying the pipe only if the sheeting is installed such that the bottom of the sheeting extends no lower than the top of the pipe. If a trench box or case is used, the rear half of the box shall have sides that do not extend below the "in place" top of the pipe.

.10 Pipes shall be stored as to prevent damage by crushing or piercing. If pipe is to be stored outside for periods longer than 60 days, the pipe shall be covered with an opaque material to protect it from prolonged exposure to sunlight. The Contractor must also provide for air circulation under the protective material.

.11 Pipe shall be checked before being lowered into the trench to ensure that no foreign material or manufacturer's defects exist that might prevent the proper jointing of the pipe or its operation. Throughout the Contract and including the operations of off-loading on delivery, handling, storing, and transporting pipes and fittings on or about the site, the Contractor shall use methods and equipment to prevent damage to the pipes and injury of workmen. Such methods shall include the use in appropriate cases of pipe hooks, lifting beams, reinforced canvas slings, struts, cradles, and pipe trailers. Pipe shall not be dropped or allowed to come into contact with any sharp object. Any pipe that has been scratched, gouged, damaged, or otherwise deemed by the Owner's Representative to be unsuitable for use, shall be replaced at the Contractor's expense.

.12 Any section of pipe containing gouges or scratches exceeding 50% of the manufacturer's recommended limits will be rejected.

.13 Temporary packing, coverings or crates provided by the suppliers for the protection of pipes and fittings in transit shall not be removed (except for purposes of inspection after which they shall be replaced) until immediately before the pipe is installed.

.14 Dispose of all cuttings from the fusion operation at a sanitary landfill.

3.8 STEEL PIPE

.1 Installation:

.1 Check pipe before being lowered into the trench to ensure that no foreign material, manufacturer's defects, or cracks exist that might prevent the proper jointing of the pipe or its operation.

.2 Repair jeeps and holidays and all skid blisters or other injuries to the protective coating, from whatever cause, before lowering the pipe into the trench.

.3 If the protective covering is damaged during the lowering-in process, remove pipe from the ditch and repair the covering to the satisfaction of Owner’s Representative.

.4 Lay pipes to AWWA C604, AWWA Manual of Practice and manufacturer's standard instructions and specifications.

.5 Join pipes in accordance with AWWA Manual of Practice and manufacturer's recommendations.

.6 Cover the open end of the pipe in the trench to prevent entrance of trench water and other material during periods when pipe is not being installed.

.7 Take precaution to ensure that displacement of the pipe in the trench does not occur through soil displacement or flotation due to the presence of trench water. Remove pipe that has been displaced from the trench and re-install it to meet the specification requirements.

.2 Slack Loops:

.1 During warm weather construction, leave slack loops to the extent required by the Owner’s Representative so that when the lowering-in operation is finally completed; the pipe in the trench will be under compression in the longitudinal direction.

.2 Lower in slack loops during the early morning hours after the intervening sections have been backfilled.

.3 When the temperature is below 0°C, do not leave any slack loops in the line at all. Rather, lay the pipe as straight as possible.

.3 Pipe Bending:

.1 Bend the pipe to conform to the bottom of the ditch with the minimum cover required and with the proper amount of slack.

.2 Measure, lay out, bend and join pipe bends so that the completed pipeline will be in compression, with the over-bends riding up off the bottom of the ditch between 200

mm and 300 mm but maintaining the minimum cover, with the sags riding down tight and the side bends riding against the outside of the ditch at the bend.

.3 Make bends by the cold smooth bending method with a full retaining shoe.

.4 Do not use cutting or welding torches to heat the pipe for bending.

.5 Do not use pipe with buckles, wrinkles, or flattening.

.6 Do not reduce any pipe diameter by more than 2-1/2 percent of the specified outside diameter of the pipe.

.7 Ensure that all bends are of uniform radius, with the curvature distributed evenly throughout as great a length of pipe as practicable.

.8 Ensure that the distance between centre lines of bends is such that there will be no unnecessary strain on the pipe or on the bend previously made.

.9 Ensure that no bend is made nearer than 1.8 m to the end of the joint of pipe. If a shorter length of straight pipe is required next to a bend (ie. S-bends), make the bend on a full joint of pipe and cut off the excess straight pipe following the bending operation.

.10 In making horizontal bends, ensure that the longitudinal seam is in the upper quadrant of the pipe, rotated at least 30° from the previous seam.

.11 For vertical bends, ensure that the seam is to be in one of the side quadrants, but not below the centreline.

.12 Determine the degree of angularity required at all bends and angles. Data for this purpose will not be supplied by Owner’s Representative.

.13 Ensure that the minimum radius of any cold bends made on epoxy lined pipe with an outside diameter of 325 mm or larger is at least forty (40) times the outside diameter of the pipe, providing for a maximum allowable bend of 1-1/2° per pipe diameter length.

.14 Owner’s Representative may request that a specimen of each wall thickness of pipe to be used on the project be bent and checked for out of round measurement. The maximum degree of bend established by this method shall govern the bending operation for the balance of the project.

.15 Contractor may utilize the natural deflection of the pipe to follow variations in the profile provided the radius is greater than 100 times the pipe diameter.

.4 Fittings:

.1 Install fittings in accordance with the requirements of CSA Z662.

.2 Jointing to be either flanged or butt welded in accordance with these specifications.

.3 Adequately support fittings to reduce the transmission of any undesirable load or stress on the adjoining pipe.

.5 Transitions:

.1 Fabricate mitered bends and transitions to AWWA M11.

.2 Submit detailed shop drawings of mitered bends and transition pieces to Owner's Representative for review prior to fabrication.

.3 After fabrication, apply, or repair if already applied, internal lining and external coating as specified elsewhere in these specifications.

.4 Install mitered bends and transitions to line and grade, and with bedding and backfill as for steel pipe.

3.9 ANCHOR PLATES, SEAL PLATES AND PIPE SLEEVES

.1 Anchor plate, seal plate and pipe sleeve details are shown on the drawings.

.2 Use anchor plates at locations shown on the drawings.

.3 Use seal plates wherever piping passes through concrete walls or slabs, except in those locations in slabs where a sleeve is indicated on the drawings.

3.10 PIPING BUILT INTO WALLS AND FLOORS

.1 Piping which is to be built into mass concrete or reinforced concrete walls and floors is to cast in at the time of concreting the walls and floors, unless otherwise required by Owner's Representative. Box-outs will not be permitted.

.2 Accurately locate piping to be built into walls and floors, with due care taken to position the bolting holes in flanged piping to the correct orientation to receive valves or other fittings mating to them.

.3 Where pipe or sleeves are to be grouted in place:

.1 Use an approved non-shrink, non-metallic grout mixture.

.2 Leave exposed non-metallic, non-shrink grout faces recessed 25 mm from final surface.

.3 Fit and finish with Portland cement grout.

.4 Do not disturb such sleeves or pipes until the grout is properly cured.

3.11 VALVE CHAMBERS

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses.

.3 Dewater excavation to approval of Owner's Representative and remove soft and foreign material before placing concrete base.

.4 Cast concrete base on 150 mm minimum of granular bedding compacted to 100% maximum density to ASTM D698.

.5 Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with Owner's Representative approved rubber ring gaskets.

.2 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.3 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.

.6 For pipelines:

.1 Place stub outlets and bulkheads at elevations and in positions indicated.

.2 Bench to provide a smooth U-shaped channel. Side height of channel to be full diameter of pipe. Slope adjacent floor at 1 in 20. Curve channels smoothly. Slope invert to establish grade.

.7 Compact granular backfill: to Section 3 04 00 - Aggregate Materials and Section 2 01 00 Excavating, Trenching and Backfilling.

.8 Place unshrinkable backfill in accordance with Section 2 01 00 - Excavating, Trenching and Backfilling.

.9 Installing units in existing systems:

.1 Where new unit is to be installed in existing run of pipe, ensure full support of existing pipe during installation, and install new unit as specified.

.2 Make joints watertight between new unit and existing pipe plus grout interior and exterior.

.3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready to be put in operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.10 Place frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.

.11 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

.12 Install safety platforms in manholes having depth of 5 m or greater, as indicated.

3.12 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated.

.2 Support valves located in valve boxes or valve chambers by means of cast-in-place concrete block or cast-in-place pipe support when in Chambers, located between valve and solid ground. Bedding same as adjacent pipe. Maximum length of pipe on each end of valve shall be 1 m. Valves not to be supported by pipe.

3.13 SERVICE CONNECTIONS

.1 Terminate building water service at edge of trench opposite point of connection to main. Install coupling necessary for connection to building plumbing. If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.

.2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.

.3 Construct service connections at right angles to watermain unless otherwise directed.

.4 Tappings on PVC-C900 pipe may be threaded without service clamps. Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used. Do not use galvanized malleable iron in corrosive soils. Tappings for PVC-C900 pipe to conform to following:

Pipe Diameter (mm)	Maximum Tap Without Clamp (mm)	Maximum Tap With Clamp (mm)
100	20	25
150	20	40
200	25	50
250	25	50
300	40	75

.5 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.

.6 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.7 Install single tap service connections on top half of main, between 45 and 90º measured from apex of pipe.

.8 Leave corporation stop valves fully open.

.9 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.

3.14 HYDRANTS

.1 Install hydrants at locations as indicated in the Construction Drawings and Contract Specifications and as per Standard Detail 7-200.

.2 Install hydrants in accordance with AWWA Manual of Practice.

.3 Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated.

.4 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 100 mm above final grade.

.5 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.

.6 To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level 150 mm above drain holes.

.7 Place appropriate sign on installed hydrants indicating if they are in service during construction.

.8 Hydrant Flow Testing

.1 All new hydrants or hydrants that were modified as part of the Work are to be flow tested. The test procedure shall be in accordance with NFPA 291. The results of the flow test are to be reported in a "Hydrant Flow Test Report" meeting the Municipality's standards and submitted to the Environmental Services department of the Municipality.

.2 The top and nozzle caps of the Fire Hydrant shall be painted in accordance with the following table. Paint shall be of a permanent, reflective type, suitable for the body material of the hydrant.

Hydrant Class	Flow Rate (at 20 psi Residual)		Top and Cap Painted Colour
	GPM	L/min	
AA	1500 +	5680 +	Blue
B	1000 – 1499	3785 – 5675	Green
C	500 – 999	1900 - 3780	Orange
D	< 500	< 1900	Red

.3 Water discharged from hydrants must be de-chlorinated prior to discharge to the storm sewers or the environment. Furthermore, the Contractor must pay for water usage, based on the measured flow rate times the duration of the test. Contact the Underground Services Department prior to performing the test.

.9 Hydrant Static Pressure Test

.1 All hydrants shall be pressure tested using the static system pressure. The procedure is as follows:

.1 Install pressure gauge and bleeder valve on hydrant port

.2 With bleeder valve open, slowly open hydrant to drain off air, and expose pressure gauge to system pressure. Close the bleeder valve.

.3 Close hydrant branch valve.

.4 Monitor pressure gauge, to ensure no pressure loss over a five-minute period.

.5 Close hydrant and re-open branch valve

.6 If the Static Pressure Test fails, the Contractor shall be responsible for repairing as required.

3.15 THRUST BLOCKS AND RESTRAINED JOINTS

.1 For thrust blocks: do concrete work in accordance with Section 3 02 30 - Cast-in-Place Concrete.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, and fittings to undisturbed ground as indicated or as directed by Owner's Representative.

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within 24 h after placing.

.5 Restrained Joints: Mechanically restrain all connections of pipe, bends, fittings and valves as indicated on the drawings. Restrainers will have UL and FM certification. All joint restraints to be wrapped in petrolatum tape and paste.

.1 Restrainer Rods: High strength, low alloy, corrosion resistant material. i.e. "Corten" in accordance with AWWA M11.

.2 Ensure tie bolts are compatible with coupling.

3.16 BACKFILL

.1 Place and compact backfill material in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling.

.2 Complete field density testing around valves, valve chambers, and vaults in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling.

3.17 PIPE DISINFECTION, CLEANING AND FLUSHING

.1 Prerequisite Requirements

.1 Prior to proceeding with the tapping of the water services, the Municipality/Owner's Representative shall review the Contractor's proposed tapping procedures with the Contractor to ensure compliance with the pipe manufacturer's written tapping procedures.

.2 The Contractor shall confirm and document that the methodology and equipment to be used for the pipe tapping procedure complies with the pipe manufacturer's recommended tapping equipment, and AWWA or industry accepted standards and guidelines for this work.

.3 No flushing, testing or disinfection of the water mains shall commence until all the mains have been completely installed, including all water distribution system. No installations of any sort shall be allowed after the mains have been flushed and/or tested.

.4 The Contractor shall submit a Water Main Flushing, Testing and Disinfecting Plan for the Owner's Representative review and documentation, two weeks after project award.

.5 The Flushing, Testing and Disinfecting Plan shall provide a detailed, step-by-step outline of the methodology(s) that the Contractor proposes to use when conducting the flushing, testing and disinfecting of the water mains.

.6 The Contractor shall provide the Owner's Representative with forty-eight (48) hours' notice of intent to proceed with the flushing, testing and disinfecting of the completed water mains.

.7 Contractor is advised the Municipality may dictate timing of water main flushing, testing and disinfecting based on water demand.

.8 The Contractor shall review the flushing, testing and disinfecting procedures with the Owner's Representative so that the Owner's Representative can check compliance with the minimum requirements of the specified requirements.

.9 The Contractor shall allow the Owner's Representative unrestricted access during the entire flushing, testing and disinfecting operation(s) to monitor the Contractor's compliance with the requirements of the Flushing, Testing and Disinfecting Plan, and to document the results of the flushing, testing and disinfection process.

.10 Flushing, testing and disinfection is to be conducted by competent and experienced personnel using equipment appropriate for the piping being flushed, tested and disinfected.

.11 When used as flushing points, hydrants shall be operated in a full-open or full-closed position only with flow modulated by a valve placed on an outlet port.

.12 The Municipality and all Municipality representatives shall have unrestricted access to the site at all times during the flushing, testing and disinfection operation.

.13 All flushing shall be in compliance with municipal by-laws for billing of water consumption.

.2 Water Main Flushing

.1 Preliminary cleaning of distribution mains and forcemains 300 mm and smaller, and service connections.

.1 Upon completion of all water main installations and the prerequisite requirements, all distribution mains and services shall be thoroughly flushed with potable water to remove entrapped air and foreign matter.

.2 Water mains shall be power flushed as per the requirements for swabbing and flushing of water mains outlined in Item 3.17.5 below.

.3 If, in the opinion of the Owner's Representative, the water main was subjected to unusual contamination during installation, the water main shall be swabbed and power flushed in accordance with the requirements given in Item 3.17.5 below.

.4 Notify the Owner's Representative of the source of the potable water. If the potable water is to be withdrawn from the Municipality's water distribution system, notify the Owner's Representative at least seven (7) days in advance of withdrawing water from the Municipality's water distribution system.

.5 The preliminary flushing procedure shall be as follows:

.1 Flushing of the water mains shall be conducted using a Uni-Directional Flushing (UDF) methodology.

.2 Power flushing shall be conducted at a minimum velocity of 1.5 m/s for a minimum duration of fifteen (15) minutes over a maximum main length of 600 m for mains up to and including 300 mm of main diameter.

.6 The Contractor shall provide a Pitot Gauge suitable for verifying the flow rate to confirm that the required flushing velocity is achieved.

.7 Test the flush water using an approved turbidimeter in the presence of the Owner's Representative.

.8 Flush and test each section of main until the turbidity is 1.0 NTU or less in three (3) consecutive tests taken five (5) minutes apart, or such duration that the Owner's Representative deems to provide an accurate representation of the length of main being flushed.

.9 The flush water shall not be discharged to the sanitary or storm sewer systems unless otherwise approved by the Municipality and in compliance with Alberta Environment and Parks guidelines for discharging chlorinated water. Flush water (and debris) shall be discharged to a suitable disposal area as reviewed and approved by the Municipality.

.2 Preliminary cleaning of water mains 350 mm and Larger.

.1 Water distribution mains shall be swabbed and power flushed.

.2 The swabbing and power flushing procedure shall be used for lines 350 mm and larger as follows:

.1 The Contractor shall include a Swabbing and Flushing section in the Water Main Flushing, Testing and Disinfecting Plan. The swabbing section shall detail the swabbing and preliminary flushing methodology. Details shall include, but not be limited to:

.1 A descriptive outline of the swabbing methodology

.2 Type and size of swabs

.3 Swab launch/retrieval locations

.4 Main sections to be swabbed

.5 Flushing velocities and durations

.6 Monitoring and documentation procedures

.7 Swab pumping pressures

.8 Method for collection and disposing of swab debris and flush water

.9 Schedule for flushing/swabbing

.10 Source of water for flushing.

.3 Swabs shall be urethane type and shall have a diameter of at least 50 mm larger than the largest pipe internal diameter.

.4 Each main section shall be swabbed by passing a minimum of four (4) swabs through the main section being swabbed including two scrubbing swabs (pigs) and two foam swabs (pigs).

.5 Swabbing of the mains shall continue until the swab shows no further evidence of foreign materials in the pipes.

.6 All pipes are to be swabbed.

.7 The Contractor shall supply and install temporary launch/retrieval ports to facilitate swabbing.

.8 Contractor to remove these items following the completion of the swabbing.

.9 Flushing of the swabbed mains shall be performed using power flushing equipment.

.10 Test the flush water using an approved turbidimeter in the presence of the Owner's Representative.

.11 Flush and test each section of main until the turbidity is 1.0 NTU or less in three (3) consecutive tests taken five (5) minutes apart, or such duration that the Owner's Representative deems to provide an accurate representation of the length of main being flushed.

.12 If the Contractor fails to achieve the specified swabbing and flushing requirements and results, Contractor may need to engage the services of a professional firm specializing in utility systems servicing and maintenance, at the Contractor's expense, to swab and flush the water mains.

.13 Where, due to pipe size, it is impractical to clean and flush the mains using the methodologies outlined above, the Water Main Flushing, Testing and Disinfecting Plan shall specifically address and detail the methodology proposed for cleaning and flushing the large diameter mains.

.3 Flushing of water main replacement sections.

.1 Tap main stops adjacent to valves at the ends of the main section to be flushed and tested.

.2 After completion of the flushing, testing and disinfection, remove the main stops and saddles.

.3 The exact methodology proposed by the Contractor shall be reviewed with the Owner's Representative prior to commencing the flushing, testing and disinfection of a water main.

.3 Hydrostatic Leakage and Pressure Testing

.1 Both a hydrostatic pressure test and a leakage test to be performed. Do tests in accordance with:

.1 AWWA C605 for PVC pipe;

.2 AWWA C600 for ductile iron pipe;

.3 AWWA M55 and ASTM 2164 for HDPE pipe;

.4 AWWA C604 for steel pipe

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described

.3 Arrange, pay and coordinate supply of potable water for hydrostatic and leakage testing. The Municipality will pay for volume of potable water required for up to 3 complete fillings of pipeline

.4 Notify Owner's Representative at least 24 h in advance of all proposed tests. Contractor to confirm that test sections will maintain pressure prior to the Owner's Representative being on-site. Perform all subsequent tests in presence of the Owner's Representative.

.5 Where any section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.6 Test pipeline in shortest possible segments (between valves), unless otherwise authorized by Owner's Representative.

.7 Pipe will be tested only after complete backfilling of trench.

.8 Leave valves, joints and fittings exposed.

.9 No testing is allowed during freezing weather, unless approved by the Owner's Representative. In such case, the Contractor shall protect valves, joints and fittings, ditch, road surface and including the test area free from ice.

.10 Install temporary struts and bracing, as required, to guard against pipe movement when test pressures are applied.

.11 The water injection rate (fill rate) shall be controlled and monitored by means of a throttling valve installed on the hydrant discharge line(s) on a temporary basis.

.12 Install corporation (main) stops where no air vacuum release valves are installed to allow for the expulsion of air. Cap and record location of the corporation (main) stops after satisfactory completion of the testing.

.13 Open all main valves within the test section.

.14 Expel air from main by slowly filling main with potable water at a filling velocity of <0.5 m/s.

.15 Fill pipe with cement mortar lining at least 24 h before testing to allow water absorption by pipe material. Fill and pressurize PVC, steel and HDPE pipes before test to allow for any expansion and stretching.

.16 The hydrostatic pressure test to be performed at 1.5 times design working pressure based on elevation of lowest point in main and corrected to elevation of test gauge, for the duration specified in item 3.17.19 in this Section.

.17 Test pressures shall not exceed the pipe manufacturer's recommended maximum test pressure.

.18 Do not conduct tests when ambient air temperatures drop below -5°C during the test period. If the temperature(s) drop below -5ºC at any time during the test, the test shall be considered invalid and a re-test will be required.

.19 The hydrostatic pressure test procedure may be as follows:

.1 Allow hydrostatic pressure to stand for 1 hour, re-pressurize as required after 1 hour to return to test pressure.

.2 Repeat for up to a maximum of 4 hours.

.3 If pressure continues to drop after 4 hours, to below 90% of the test pressure, the hydrostatic pressure test is deemed to have failed.

.4 Relax the test pressure on the pipeline and let stand for a minimum of 12 hours.

.5 The hydrostatic pressure test is to be repeated until the pressure drop after 1 hour is less than 35 kPa. The leakage test may then be performed.

.20 The leakage test for PVC and Ductile Iron Pipe is to be performed. To pass the leakage test, the volume of makeup water must not exceed the calculated volume of allowable makeup water as per the following tables.

Allowable Makeup for PVC Plastic Pipe with Elastomeric Joints (Litres per Hour)

Nominal Pipe Size *mm)	345 kPa (50 psi)	690 kPa Average Test (100 psi)	1035 kPa Pressure (150 psi)	1380 kPa (200 psi)
	Allowable Makeup Per 50 Joints (305m)			
100	0.72	1.02	1.25	1.44
150	1.10	1.55	1.89	2.16
200	1.44	2.04	2.50	2.88
250	1.82	2.57	3.14	3.63
300	2.16	3.07	3.75	4.35
350	2.54	3.60	4.39	5.07
400	2.88	4.09	5.0	5.79
450	3.26	4.62	5.64	6.51
500	3.63	5.11	6.28	7.23
600	4.35	6.13	7.53	8.67
750	5.41	7.68	9.39	10.86
900	6.51	9.20	11.28	13.02

Allowable Makeup Water per 300 m of Pipeline For Ductile Iron Pipe

Avg. Test Pressure kPa (psi)	Nominal Pipe Diameter (mm)						
	305	356	406	457	508	610	762
1,800 (261)	4.88	5.70	6.50	7.32	8.14	9.77	12.20
1,600 (232)	4.60	5.37	6.13	6.90	7.67	9.21	11.50
1,400 (203)	4.31	5.03	5.73	6.45	7.17	8.62	10.76
1,200 (174)	3.99	4.65	5.31	5.98	6.64	7.98	9.96
1,000 (145)	3.64	4.25	4.85	5.45	6.06	7.28	9.10
800 (116)	3.26	3.80	4.33	4.88	5.42	6.51	8.14
600 (87)	2.82	3.29	3.75	4.23	4.70	5.64	7.05

.21 For HDPE pipe, allow for initial pipe expansion before initiating the hydrostatic test:

.1 During the expansion phase, when the test section is completely filled and purged of air, gradually increase pressure in the test section to the required test pressure.

.2 If the test pressure cannot be attained, or if it takes an unreasonably long time to reach test pressure, there may be faults such as excessive leakage or entrapped air etc. If faults exist, discontinue pressuring, and correct them before continuing.

.3 Add make-up water as necessary to maintain maximum test pressure for 4 hours.

.4 During the test phase, reduce test pressure by 69 kPa (10 psi) and monitor the pressure for 1 hour. (Do not increase pressure or add make-up water).

.5 If no visual leakage is observed, and pressure during the test phase remains steady (within 5% of the test pressure) for the 1 hour test phase period, a passing test is indicated.

.6 If the test including the time required to pressurize, stabilize, hold test pressure and depressurized is not completed due to leakage or any other reason within 8 hours, the test section should be permitted to relax for at least 8 hours before repeating the test.

.22 For Steel Pipe:

.1 The pipe shall hold the test pressure for 2 hours.

.2 There should be no leakage in all-welded pipeline.

.23 Thoroughly examine exposed joints and correct for leakage as necessary.

.24 Remove pipes, joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.25 Repeat hydrostatic test until all defects have been corrected.

.26 There shall be zero leakage. Repeat hydrostatic test until all defects have been corrected. Contractor is responsible for all cost on repeat tests.

.27 Arrange, and coordinate with the Municipality for the supply of potable water for hydrostatic leakage testing.

.28 Notify Owner’s Representative at least 24 h in advance of all proposed tests. Contractor to confirm that test sections will maintain pressure prior to Owner’s Representative being on-site. Perform tests in presence of Owner’s Representative.

.29 Where any section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.30 Test pipeline in shortest possible segments (between valves), unless otherwise authorized by Owner’s Representative.

.31 Pipe will be tested only after complete backfilling of trench.

.32 Air testing of water mains.

.1 The use of compressed air for pressure testing water distribution mains and forcemains shall NOT be allowed under any circumstances.

.4 Water Main Disinfecting and Final Flush

.1 Disinfecting and final flushing of water mains and services

.1 Chlorination of Mains

.1 Upon the completion of the flushing, pressure and leakage testing, to the satisfaction of the Owner's Representative, all distribution mains, services and supply mains tested shall be disinfected in accordance with the Contractor's Water Main Flushing, Testing and Disinfecting Plan which shall consider the following requirements.

.2 The Contractor shall provide the Owner's Representative with the MSDS sheets for the type of chlorination and dechlorination agents to be used for the disinfection and dechlorination process.

.3 Disinfect and flush the mains in accordance with the latest edition of AWWA Standard C651 for Disinfecting Water Mains.

.4 An aqueous chlorine solution of calcium hypochlorite or sodium hypochlorite shall be injected into the main being disinfected while sufficient water is being discharged through the main to bring the chlorine concentration throughout the main to a minimum concentration of 50 mg/L (50 ppm) and a maximum concentration of 100 mg/L.

.5 The use of chlorine tablets will not be allowed.

.6 The disinfecting, testing and final flushing procedure must be witnessed by the Owner's Representative.

.7 The chlorine solution shall be injected at the start of the water main test section with the discharge at the extreme end of the test section.

.8 Take samples from various sampling points along the main and test, using an approved test kit, to confirm that the entire test section is at the specified chlorine concentration.

.9 Once the Contractor has confirmed that the entire test section is at the specified chlorine concentration, the intake and discharge valves shall be closed and the test section left to stand a minimum of twenty four (24) hours.

.10 The water shall be tested after the 24-hour contact period has elapsed to check that a minimum chlorine residual of 25 mg/L is still present in the main.

.11 If the minimum residual chlorine concentration is not present, repeat the chlorination procedure for another 24-hour contact duration until the specified results are achieved.

.12 At the beginning of the contact period, all valves (including hydrant valves) and hydrants shall be operated to ensure that all parts have been in contact with the chlorine solution.

.2 Dechlorination of Super Chlorinated Water

.1 Super chlorinated water must be dechlorinated before being discharged to the environment.

.2 Dechlorination of the super chlorinated water shall be completed with Ascorbic Acid (Vitamin C) as per manufacturer's instructions.

.3 The dechlorinated water must be periodically field tested during the final flushing operation to confirm the effectiveness of the dechlorination process. Dechlorinated water exceeding a total chlorine concentration >0.5 mg/L shall not be discharged to the environment.

.4 Chlorinated water shall not be released into a storm sewer, ditches or water courses flowing into lakes, canals or wetlands.

.5 If the dechlorinated water exceeds a chlorine concentration of 0.5 mg/L, discontinue the flushing and dechlorination procedure and increase the strength of the sodium thiosulphate solution until the dechlorinated water's chlorine concentration is confirmed to be <0.5 mg/L.

.6 Continue flushing and dechlorinating until testing of the flush water confirms a chlorine residual in the range of 0.2 mg/L to 0.5 mg/L, with a turbidity level of <0.5 NTU.

.7 Dechlorinated flush water shall be discharged to a disposal area(s) approved by the Owner's Representative and any local and/or provincial authorities having jurisdiction.

.8 Upon satisfactory completion of the chlorinating and final flushing, the tested section of water main shall be isolated from all other water mains pending the results of the bacteriological testing.

.3 Final Flushing of Water Mains

.1 After successful completion of the disinfection process, the test section shall be flushed with potable water to expel all super chlorinated water.

.2 Final flushing through the mains shall be conducted so that the flushing velocity ranges between 0.5 m/s and 0.75 m/s.

.3 Flush until the chlorine residual is in the range of 0.2 mg/L to 0.5 mg/L with a turbidity level of <0.5 NTU.

.4 Mains shall pass bacteriological testing before being put into service.

.5 For water mains that will be placed into immediate service or replacement portions of existing water mains, flush the mains until the chlorine residual is >0.2 mg/L.

.5 Sampling and Bacteriological Testing

.1 Immediately after the specified final flushing results have been achieved and verified by the Owner's Representative, the Contractor shall obtain a minimum of three (3) water samples. One each at the start, middle and end of the water main section being tested.

.2 Samples shall be obtained from sampling points at the main, hydrants, service(s) or temporary sampling points provided by the Contractor.

.3 Samples taken from temporary flushing hoses and devices are not acceptable.

.4 Water samples shall be submitted to an approved and certified testing laboratory (a city's water resources lab, Provincial Health lab, private testing firm) within twelve (12) hours of the sample being taken.

.5 The samples shall be tested for microbiological parameters, including total and fecal coliforms.

.6 Copies of the laboratory report shall be submitted to the Owner's Representative prior to commissioning the water main.

.7 Should any of the tests indicate that the water failed to meet the biological requirements, the Contractor shall repeat the disinfecting and final flushing procedure until the biological tests indicate that the water in the main complies with the specified requirements.

.8 When the water quality and bacteriological tests meet the specified criteria and have been reviewed by the Owner's Representative, the water main(s) may be commissioned for immediate use.

.9 If immediate commissioning of the water main is not required, the main shall be left fully charged and isolated.

.10 If the tested and disinfected water mains (or portions thereof) lie dormant for a period of greater than 30 days, the stagnant water in the dormant mains shall be flushed out with potable water until test results indicate that the chlorine residual in these mains is >0.2 mg/L.

.6 Monitoring, Documentation and Reporting

.1 Monitoring of the work

.1 The Owner's Representative shall be the primary authority responsible for monitoring the works for compliance with these and other applicable requirements and quality control standards.

.2 The Owner's Representative shall conduct inspections at his discretion and report any noted deficiencies and/or quality and workmanship concerns and issues to the Contractor and Owner.

.3 All noted deficiencies, quality control concerns and workmanship issues must be addressed and resolved to the satisfaction of the Owner's Representative prior to the issuance of the Construction Completion Certificate (CCC).

.2 Documentation

.1 The Contractor shall document the detailed methodologies and results of all aspects of the water main flushing, testing and disinfecting procedures.

.2 The documentation shall include a brief description of any ‘unusual’ events that may have occurred during the construction of the mains that led to the selection of a particular methodology for flushing the mains.

.3 Documentation shall be provided for all sections of water mains flushed, tested, and disinfected, including failed attempts/tests and retests (not just the final successful tests).

.3 Final report

.1 The Contractor shall prepare a Final Report of the flushing, testing, and disinfecting of the water mains, based on the documented information compiled during the execution of these procedures.

.2 A draft copy of the Final Report shall be submitted to the Owner’s Representative for review and comment prior to the Contractor finalizing the Report.

.3 The Final Report shall include:

.1 The Flushing, Testing and Disinfecting Plan

.2 The documentation of the flushing, testing and disinfecting procedures.

.3 Any photographs taken to record the flushing, testing, and disinfecting of the water mains.

.4 The format of the hard copy of the Final Report shall include:

.1 A covered and bound (Cerlox) report.

.2 The front cover of the report shall include:

.1 The Municipality’s corporate name and logo

.2 The Project name and number

.3 The Contractor’s name

.4 The Owner’s Representative’s corporate name and logo

.5 The report’s title (e.g. “Final Flushing, Testing and Disinfecting Report for ‘project name’, ‘Municipality’s name’ by ‘Contractor’)

.6 Date (Month/Year).

.3 A table of contents

.4 Appendices, as required.

.5 The deliverables submitted to the Owner’s Representative shall include:

.1 Five (5) hard copies of the Final Report with a CD.

.2 Three (3) CDs of the Final Report.

.3 A PDF of the Final Report sent to the attention of the Owner's Representative.

.6 The Final Report must be received by the Owner's Representative prior to the issuance of the Construction Completion Certificate (CCC) to the Contractor.

3.18 TEMPORARY WATER SUPPLY PROCEDURES

.1 Temporary water service connections are mandatory on all water main upgrading and rehabilitation projects.

.2 Contact the Municipality two weeks before construction to arrange for the disconnection of existing water meters on private lands.

.3 The Contractor shall obtain a hydrant permit from the RMWB prior to commencement of the temporary water service.

.4 The Contractor shall ensure that the maximum spacing between active hydrants does not exceed a 200 m radius.

.5 The Contractor shall install a temporary hydrant if more than one hydrant is out of service,

.6 Hydrants out of service shall be bagged and clearly marked with "Hydrant out of service" tag.

.7 Temporary bypass facilities shall include hoses and necessary outlets and fittings to each service connection and/or fire line. The bypass connection may be made at the water meter or at a spigot where possible. The Contractor shall provide, install and maintain the temporary bypass lines in a safe and operable working condition at all times. The Contractor shall be required to mound over the temporary water service bypass wherever it crosses a street, driveway, or sidewalk in order to prevent injury to vehicular and pedestrian traffic. After service has been restored to a section of water main, the Contractor shall remove the temporary bypass and related facilities and shall leave the work site in a neat and orderly condition.

.8 The bypass system shall be installed as to minimize disruption to the public including providing vehicular access to driveways, lanes, and parking lots.

.9 Each building shall have its own temporarily water service connection to the bypass pipe and a connection to the private plumbing via wye at an outside tap. An approved building connection vacuum breaker shall be supplied on the open ends of all wyes.

.10 The temporary water service connections shall be valved near the point of connection to the temporary water main and valved near the point of connection to the private building. Temporary water services shall be connected to a 2.5" hydrant port. All 4" hydrant ports shall remain accessible for use by the Fire Department.

.11 The Contractor shall have adequate standby equipment at the construction compounds ready for immediate operation and use in the event of an emergency breakdown.

.12 The bypass pumping system shall be capable of bypassing the flow around the required work area and shall be sized to accommodate the anticipated water demands including fire flows.

.13 The Contractor shall inform the Municipality before he starts any work which will affect service to customers. The Municipality may instruct the Contractor to notify customers. Contractor shall inform residents a minimum of seven (7) days prior to temporary water lines being "laid out" at properties. The Contractor shall have a 24-hour customer contact number in the event of a system malfunction. Shutoffs to customer service lines and connections from the bypass line to the customer service lines shall be made by the Municipality.

.14 In addition, and if required by the Municipality, the Contractor shall make bypass service connections requiring excavation, cutting, or tapping, unless specifically excluded.

.15 The Contractor shall be responsible for restoring service to the customer to original or better flow and pressure, including disconnecting from the bypass system and reconnecting to the pipeline.

.16 The services shall be flushed before customers are disconnected from the temporary water system and reconnected to the permanent network.

.17 The Contractor shall follow RMWB Temporary Water Service Procedures for water meter removals.

.18 The Contractor is fully responsible for coordination and scheduling of water meter removal and reinstatement with both RMWB UGS and residents.

.19 The Contractor is expected to provide temporary water to residents prior to removal of water meters.

.20 The Contractor is fully responsible for the water meters during the process of removal and re-instalment. Should water meters be damaged during this process the Contractor will be financially responsible for the replacement of the water meter.

.21 The Contractor is fully responsible for any damages to residential properties while conducting the removal and re-instalment of water meters.

.22 The contractor shall make all shut offs of consumers services and the final connections from the bypass pipe to the consumer using flexible hose.

.23 Flexible fire hose will not be approved by the Municipality for use as temporary water supply to residents or businesses.

.24 Notification to the Engineer and Fire Department is required whenever temporarily water service is changed.

.25 Temporary Hose Materials

.1 All piping for temporary water services shall be certified for potable water use.

.2 Temporary above-ground water connections are to be CSA-200 Municipal piping.

.3 All materials used for temporary water services shall only be used for that purpose and shall not be used to perform any other function.

.4 The pipe and other materials shall be provided by the Contractor for use in conjunction with temporary bypass pipe and connections to services and laterals. These materials shall be fully adequate to withstand the working pressures of 620 kPa operating within the existing network and all other conditions of use. The pipe and fittings shall be watertight and shall be HDPE pipe which is approved for potable water applications to a recognized standard (NSF/ANSI 61) and shall be disinfected before being put into service.

.26 Temporary Hose Diameters:

.1 Temporary mains (headers) shall be a minimum of 40 mm in diameter.

.2 Single family residential service laterals shall be a minimum of 13 mm in diameter.

.3 Existing 40 mm and 50 mm services will require a minimum of two – 13 mm service laterals.

.4 Existing 100 mm to 200 mm services will require two 40 mm laterals.

.27 Temporary Hose Connections:

.1 All laterals shall be installed with control valves at the connection to the temporary main with an outlet for the residents use near the tie-in to the hose bib.

.2 Appropriate back-flow preventers must be installed on all hydrants being used to supply temporary water.

.28 Temporary Hose Disinfection and Storage:

.1 Disinfection shall be carried out by the Contractor unless otherwise specified by the Owner and shall be flushed and chlorinated according to Ansel/AWWA C651.

.2 Prior to the start of the construction season, the contractor shall disinfect all temporary hoses using a sodium or calcium hypochlorite solution. Using the same procedure used to disinfect water mains, the contractor shall ensure a minimum chlorine residual at the end of 24 hours of 10 mg/L.

.3 After disinfection, the hoses shall be adequately flushed. Chlorinated water shall be dechlorinated and disposed of in accordance with the Municipality’s sewer bylaws.

.4 When removing and transporting temporary water hoses between construction projects, the ends of all headers and laterals must be capped to prevent contamination.

.5 Headers and laterals should be adequately flushed prior to use on every project.

.6 If a temporary water hose is placed in storage and is not moved directly from one construction project to another, it must be re-disinfected prior to use.

.29 Initial Water Quality Sampling:

.1 Prior to connecting customers to the temporary water supply, water quality samples must be collected and submitted for testing. After flushing, the water must be allowed to sit in the temporary hoses for a minimum of 16 hours before samples are collected.
.2 Water samples should be collected from the furthest end of the temporary water supply.
.3 Each set of samples should include one plastic container for bacteriological testing.
.4 All samples must be passed before customers can be switched over to the temporary water supply.
.5 Water quality samples must be collected on every construction project.

.30 Interim Water Quality Sampling:

.1 To ensure water quality is being maintained, interim water samples must be collected on all construction projects every two weeks the temporary water sample hoses are in use.
.2 Each set of samples should include one plastic container for bacteriological testing.
.3 If samples cannot be collected from an existing lateral, samples should be collected from the inside tap of the property furthest from the temporary supply point.

4 Measurement and Payment

4.1 WATER MAINS

.1 Water mains will be measured in lineal meters of each size and type of pipe installed, as shown in the Bid Form.

.2 Horizontal measurement will be made over surface, after work has been completed subject to the limits of payment shown on the drawings.

.3 Unit price for water mains to include the supply and installation of pipe, fittings, bends, thrust blocking, joint restraint, tracer wire, cathodic protection including continuity bond strap around fittings, and crossing of existing utilities, where required and identified on the drawings.

.4 Measurement and payment for water main tie-in will be paid separately.

.5 No separate payment will be made for manholes, valve chambers and pre-cast structures. Include costs in related Sections.

.6 Refer to Excavating, Trenching and Backfilling section for measurement of trenching and backfilling depth within a roadway or greenfield.

.7 No separate payment will be paid for watermain disinfection, cleaning, flushing, and testing.

4.2 VALVES

.1 Supply and installation of valves will be measured in each unit of each size, and type of valve installed, as shown in the Bid Form.

.2 Unit price to include the supply of valve, installation of valve, valve stem extension to surface, valve box, fittings, piping, bedding, thrust blocking, cathodic protection, valve box final grade adjustment and all work incidental thereto to the limits indicated on the drawings.

4.3 HYDRANTS

.1 Supply and installation of hydrants will be measured in each unit installed, as shown in the Bid Form.

.2 Unit price to include the supply of hydrant, installation of hydrant, supply and installation of hydrant valve, fittings, piping, bedding, thrust blocking, cathodic protection, and all work incidental thereto to the limits indicated on the drawings.

4.4 WATER SERVICES

.1 Supply and install water service for the specified sizes will be measured and paid for by the meter measured from the center of the main line to the curb stop.

.2 The Unit Price shall include but is not limited to saw cutting, supply and installation of service pipe, curb cock complete, connection at mainline and property line, all required fittings, labour, materials, dewatering, equipment, and all other incidentals required to perform the work.

4.5 WATER TIE-IN

.1 Tie-ins will be measured and paid for per tie-in made.

.2 Unit price to include saw cutting, excavation, exposing, cutting, removals, cleaning and preparation of existing pipe, connection to existing pipe, fittings, testing, cathodic protection, backfilling and all other work incidental to the tie-in.

4.6 TEMPORARY WATER SUPPLY

.1 Include a lump sum for all costs involved in planning, preparation, setup, teardown of temporary water supply as required to complete the Work and as approved by the Municipality.

.2 The lump sum price will be paid as a percent complete approved by the Owner’s Representative.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C 14M, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
.2 ASTM C 76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
.3 ASTM C 443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
.4 ASTM D 3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
.5 ASTM D 3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
.6 ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
.7 ASTM F794, Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA – A257, Standards for Concrete Pipe and Manhole Sections.
.2 CAN/ CSA-A3000, Cementitious Materials Compendium
.3 CSA B181.2, PVC Drain, Waste, and Vent Pipe and Fittings
.4 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.
.5 CAN/CSA-B182.2, PVC Sewer Pipe and Fittings (PSM Type).
.6 CAN/CSA-B182.4, Profile Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
.7 CSA B182.6, Profile Polyethylene (PE) Sewer Pipe and Fittings for Leak-proof Sewer Applications.
.8 CSA B182.11, Recommended Practice for the Installation of Plastic Drain and Storm, and Sewer Pipe and Fittings.
.9 CAN/CSA – Z245.1, Steel Line Pipe

1.2 SUBMITTALS

.1 At least two (2) weeks prior to commencing work, inform Owner’s Representative of proposed source of bedding materials and provide access for sampling.

.2 Submit shop drawings in accordance with Section 1 04 00 - Submittal Procedures.

.3 Indicate proposed method for installing carrier pipe for undercrossing.

.4 At least two (2) weeks prior to commencing work submit manufacturer's test data and certification that pipe materials meet requirements of this section.

1.3 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Notify Owner's Representative and building owner 24 hours minimum in advance of any interruption in service.

.3 Maintain existing sewage flows during construction.

.4 Submit schedule of expected interruptions for approval and adhere to approved schedule.

2 Products

2.1 GRAVITY SEWER MAIN PIPE

.1 Polyvinyl Chloride (PVC) - ASTM D3034, CSA B182.1, CSA B182.2 and ASTM F679100mm to 1500mm diameters.

.2 Standard Dimension Ratio SDR 35.

.3 Minimum Pipe Stiffness 320 kPa.

.4 Locked-in gasket and integral bell system.

.5 Sealing gaskets shall meet the requirements of CSA B182.4 and ASTM F477.

.6 Fabricated PVC fittings to CSA B182.4 or ASTM F794

.7 Nominal lengths: 4 or 6m.

.8 PVC open profile sewer pipe and fittings: to CSA B182.4 for diameters 200mm to 1500mm.

.2 Reinforced Concrete Pipe - CAN/CSA-A257/ASTM C 76M.
(525mm and larger)

.1 Class III minimum strength classification

.2 Flexible rubber gasket joints to CAN/CSA-A257/ ASTM C 443M

.3 Lifting holes:

.1 Pipe 900 mm and less diameter no lift holes.

.2 Pipe greater than 900 mm diameter lift holes not to exceed two in a piece of pipe.

.3 Provide pre-fabricated plugs to seal lift holes watertight after installation of pipe.

.3 Steel Casing Pipe – CAN/CSA-Z245.1

.1 Diameter to allow for casing spacers with an additional 40mm.

.2 Steel Grade 241 (unless higher grade is required by crossing owner)

2.2 SEWER SERVICE CONNECTIONS

.1 Polyvinyl Chloride (PVC) - ASTM D3034, CSA B182.2

.1 DR28 with push-on joints.

2.3 CEMENT MORTAR

.1 Portland cement: to CAN3-A3000 normal type 50 sulphate resistant.

.2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient water after mixing to give optimum consistency for placement. Do not use additives.

2.4 PIPE BEDDING AND SURROUND MATERIALS

.1 Granular material in accordance with Section 2 01 00 - Excavation, Trenching and Backfilling.

.2 Granular material to Section 3 04 00 – Aggregates Materials and following requirements:

Acceptable Bedding Material Gradation	
	% Passing
10,000	100
5,000	50 – 100
2,000	30 – 90
400	10 – 50
80	0 – 10

.3 Concrete required for cradles, encasement, supports, thrust blocks, all to Section 3 02 30 - Cast-in-Place Concrete.

2.5 BACKFILL MATERIAL

.1 Place backfill in accordance with Section 2 01 00 - Excavating, Trenching and Backfilling.

.2 Unshrinkable fill: to Section 2 01 00 - Excavating, Trenching and Backfilling.

2.6 SEWER LINE WARNING SIGN

.1 Warning signs for sewer lines are to be installed in locations identified in Construction Drawings and Contract Specifications.

.2 Signs are to be in accordance with Standard Detail 5-812.

.3 Sign size: 432mm x 305mm, Aluminum, Layout and colours in accordance with Standard Detail 5-812.

.4 Mount signs on Telespar, set 0.9m in ground at a height of 1.5m.

3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

3.2 TRENCHING AND BACKFILL

.1 Do trenching and backfill work in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling.

.2 Do not allow contents of any sewer or sewer connection to flow into trench.

.3 Trench line and depth require approval prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

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

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% SPD.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures such that the minimum compaction requirements specified are achieved.

3.4 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.4 Place layers uniformly and simultaneously on each side of pipe

.5 When field test results are acceptable to Owner's Representative place surround material at pipe joints.

.6 Compact each layer from pipe invert to underside of backfill to at least 95 % SPD.

3.5 UNDERCROSSING

.1 For Augered Crossing, refer to Section 2 09 00 – Augured Crossings.

.2 For Microtunneling, refer to Special Provision.

3.6 INSTALLATION

.1 Confirm all inverts prior to commencement of construction.

.2 Lay and join pipes in accordance with manufacturer's recommendations.

.3 Handle pipe with equipment approved by Owner's Representative. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.

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

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

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

.7 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.8 Do not allow water to flow through pipe during construction, except as may be permitted by Owner's Representative.

.9 Whenever possible, reconnect piping at the end of each work shift.

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

.11 Install PVC pipe and fittings in accordance with CSA B181.2.

.12 Pipe jointing:

.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 contaminating 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 At rigid structures, install pipe joints not more than 1.2 m from side of structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.13 Block pipes as directed by Owner’s Representative when any stoppage of work occurs to prevent creep during down time.

.14 Plug lifting holes with prefabricated plugs approved by Owner’s Representative, set in non-shrink grout.

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

.16 Make watertight connections to manholes using pre-benched manhole sections.

.17 Upon completion of pipe laying and after Owner’s Representative has inspected pipe joints, place specified granular material to dimensions indicated or directed by Owner’s Representative and in accordance with Section 2 01 00 - Excavating Trenching and Backfilling.

.18 When infiltration and exfiltration test results are acceptable to Owner’s Representative, backfill remainder of trench in accordance with Section 2 01 00 - Excavating Trenching and Backfilling.

3.7 SERVICE CONNECTIONS

.1 Install pipe to CSA B182.11 and manufacturer's standard instructions and specifications.

.2 Install sanitary services to vacant or unserviced properties as per direction from Owner’s Representative.

.3 For service connection details, see Standard Details 5-500 and 5-501.

.4 Sanitary sewer service connections for commercial, industrial, multi-family or institutional areas, unless otherwise approved by the Municipality, will only be made after the service requirements have been determined and a permit, approving the installation, is issued by the Municipality.

.5 Sanitary sewer service connections are to be installed as a single connection from the main to the property line in common trench with water service.

.6 If there is an easement for shallow utilities adjacent to the road right-of-way, the service connection shall be 1m beyond the limits of the shallow utility easement.

.7 All sanitary sewer service connections should be installed with a minimum 2.0% slope and with a minimum cover of 3.0 m at the property line. Where this cannot be achieved, the slope may be reduced to 1.0% if an inspection chamber is provided 0.5 m outside of the property line.

.8 Sanitary sewer service connection materials shall be polyvinyl chloride (PVC) DR28 building service pipe conforming to CSA specification B182.2, latest revision thereof.

.9 Sanitary service connections shall be made using in-line tee and shall not be connected to manholes. Exceptions will be clearly noted in the Construction Drawings and Contract Specifications.

.10 Pipe saddles or inserta tees shall be used to connect sanitary sewer services to mains in instances where retrofit work is undertaken.

.11 Risers shall be employed where the service connection at the main is 4.0m or deeper.

.12 The end of the sewer service connection shall be adequately capped or plugged to prevent the entry of soil, water, or other deleterious material into the pipe. The end of the pipe shall be marked by a vertical, nominal size 2" x 4" timber set at the service invert and extending 1m above the top surface of the surrounding ground. The top 300mm of the exposed portion of this marker shall be painted red.

.13 Roof leaders and building foundation drains shall not be connected to the sanitary sewer system.

.14 Always orient sanitary sewer service lateral between the water and storm service laterals, as per Standard Detail Drawings.

.15 Service connection pipe: not to extend into interior of main sewer.

.16 Make up required horizontal and vertical bends from 45° bends or less, separated by straight section of pipe with minimum length of four pipe diameters. Use long sweep bends where applicable.

.17 Plug service laterals with watertight caps or plugs as approved by Owner's Representative.

.18 Service connections to extend1.0 m beyond easement line.

3.8 QUALITY ASSURANCE

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Owner's Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Exfiltration test:

.1 Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are commenced.
.2 Immediately prior to test period add water to pipeline until there is a head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static ground water level, whichever is greater.
.3 Duration of exfiltration test: 2 hours.
.4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.

.5 Infiltration test:

.1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 1 meter or more above top of pipe measured at highest point in line to be used.
.2 Install watertight plug at upstream end of pipeline test section.
.3 Discontinue pumping operations for at least 3 days before test measurements are to commence and during this time, keep thoroughly wet at least one third of pipe invert perimeter.
.4 Prevent damage to pipe and bedding material due to flotation and erosion.
.5 Place 90º V-notch weir, or other measuring device approved by Owner's Representative in invert of sewer at each manhole.
.6 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.

.6 Infiltration and exfiltration: not to exceed following limits in L per hour per 100 m of pipe, including service connections.

Table 1: Infiltration and Exfiltration limits for PVC and Concrete Pipe

Nominal Pipe Diameter in mm	PVC Pipe[1] (L/hour for 100m)	Concrete Pipe[2] (L/hour for 100m)
100	1.91	9.32
125	2.39	11.65
150	2.88	13.98
200	3.83	18.64
250	4.79	23.3
300	5.75	27.96
350	6.71	32.62
400	7.67	37.28
450	8.63	41.94
500	9.58	46.6
550	10.54	51.26
600	11.5	55.93
700	13.42	65.24
800	15.33	74.57
900	17.25	83.89
1000	19.17	93.21
1100	21.12	102.53
1200	23.04	111.85

Notes: (1) Uni-Bell Handbook – 4.6 1/mm of diameter/km/day

(2) Concrete Pipe Handbook – 22.37 1/mm of diameter/km/day

.7 Values shown in columns 2 and 3 are in litres per hour per 100 metres of pipe.

.8 Contractor to supply and dispose of all the water required for the tests.

.9 Repair and retest sewer lines as required, until test results are within limits specified.

.10 Repair visible leaks regardless of test results.

.11 Deflection Testing:

.1 Following Owner's Representative review of CCTV Inspection report of all new PVC Sewers 200mm diameter or larger, perform Mandrel tested as requested by Owner's Representative.

.2 The Mandrel will be of cylindrical shape, with the minimum length of the cylinder 1.5 times the diameter and a minimum outside diameter not less than 95% of the inside diameter of the sewer.

.3 The Mandrel will be pulled by hand through all sections of the sewer.

.4 The Mandrel material shall be steel.

.5 Deflection testing must be conducted within 30 days of pipe installation.

.6 If the Mandrel is unable to pass through the pipe, the contractor is to measure the exact inside diameter of the pipe with a deflectometer. If the pipe deflections are found to exceed 7.5%, the pipe is to be replaced.

.7 Repair and retest sewer line as required, until test results are within limits specified.

.8 Repair visible leaks regardless of test results.

.12 CCTV Video Inspection

.1 The sewer inspection method is image-based inspection. The following specifications will pertain to image-based inspection hardware, software, and output. Sewer inspections shall be performed to observe and record structural and service defects and construction features, to assess thoroughness of cleaning, and to verify new installation and rehabilitation work quality prior to acceptance. All observations shall be coded in accordance with the latest version of Pipeline Assessment & Certification Program (PACP) codes, and the findings shall be submitted in an inspection report consisting of a hardcopy data file and the original video recording (in digital format on CD-R, DVD, portable hard drive, or USB flash drive). Condition coding shall only be performed by operators who have either successfully attained PACP certification.

.2 All pipe up to and including 1200 mm diameter shall be inspected with image-based video inspection. Upon approval of the engineer, the exceptions to this inspection requirement include force mains, and catch basin leads. Pipe larger than 1200 mm diameter may be inspected and observations recorded during a walk-through by an operator with PACP certification, or by image-based inspection where authorized by the Engineer.

.3 Perform inspection after all mains, manholes and service connections have been installed and backfilled.

.4 The camera transport shall permit complete inspection of the sewer from the centre of the start manhole to the centre of the finish manhole. The camera transport and cable shall inspect a minimum of 200 m of sewer from a single access point. A remote reading counter shall be used to measure distance traveled from the centre of the start manhole and measurements shall be recorded in metres to the nearest 100mm.

.5 The camera height shall be adjustable, to position the centre of the lens in the centre of circular sewers.

.6 Sewer Condition Reports The sewer condition shall be coded in accordance with the latest version of PACP codes. The sewer condition reports shall consist of a hardcopy data file and original video recording (in digital format on CD-R or DVD, portable hard drive, or USB flash drive.

.7 A television work report, in log form, shall be maintained during the inspection. This log shall show the exact location of each leak or fault discovered by the television - e.g., open joints, broken, cracked, or collapsed pipe, presence of grease, roots, debris, accumulation, obstructions, infiltration, water depth variations and other points of significance. The reference location shall include the distance away from the reference manhole and the position of the leak or fault as referenced to the crown of the pipe using clock face notation.

.8 The report shall include the location and photograph of all service connections together with a statement of opinion as to whether the service connections are leaking. Protrusions of the service connections into the mainline shall be noted with reference to the degree of protrusion.

.9 Still photographs of all sewer defects shall be taken. The photographs shall be coordinated with the written report by reference numbers. A minimum of one photograph per reach of sewer shall be taken to show a representative view of the workmanship, as well as additional photographs of deficiencies and service connections as required.

4 Measurement and Payment

4.1 SANITARY SEWER PIPE

.1 Sanitary sewer pipe shall be measured and paid for by the meter for the sizes indicated in the bid form. Measurements shall be taken along the centerline of the installed pipe accepted by the Owner’s Representative.

.2 The unit price to include all materials, labour, equipment, supervision, fittings, plugs, tie-ins, and incidentals required to install the pipe as per the specifications.

4.2 SANITARY SERVICE PIPE

.1 Sanitary sewer service pipe shall be measured and paid for by the meter for the sizes indicated in the bid form. Measurements shall be taken along the centerline, including all fittings, of the installed pipe accepted by the Owner’s Representative.

.2 The unit price to include all materials, labour, equipment, supervision and incidentals required to install the pipe as per the specifications.

4.3 INFILTRATION/EXFILTRATION TESTING

.1 If requested by the Owner's Representative, infiltration and/or exfiltration testing paid for upon completion.

.2 The lump sum unit price to include all materials, labour, equipment, supervision, flushing, cleaning, traffic control and incidentals required to complete the testing.

4.4 CCTV VIDEO INSPECTIONS

.1 CCTV video inspection shall be measured and paid for by the meter. Measurements shall be taken along the centerline of the installed pipe accepted by the Owner's Representative.

.2 The unit price to include all materials, labour, equipment, supervision, flushing, cleaning, traffic control and incidentals required to complete the video.

.3 No separate payment will be made for deflection/mandrel testing, if requested.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C110/A21.20, Ductile Iron and Grey Iron Fittings.
.2 ANSI/AWWA C111/A21.11, Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
.3 ANSI/AWWA C200, Steel Water Pipe, 6 In. (150 mm) and Larger.
.4 ANSI/AWWA C206, Field Welding of Steel Water Pipe
.5 ANSI/AWWA C207, Steel Pipe Flanges for Waterworks Service, Sizes 4 In. through 144 In. (100 mm through 3,600 mm)
.6 ANSI/AWWA C210, Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
.7 ANSI/AWWA C213, Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
.8 ANSI/AWWA C504, Rubber-Seated Butterfly Valves
.9 ANSI/AWWA C507, Ball Valves, 6 In. through 60 In. (150 mm through 1,500 mm).
.10 ANSI/AWWA C512, Air-Release, Air/Vacuum and Combination Air Valves for Water and Wastewater Services.
.11 ANSI/AWWA C600, Installation of Ductile-Iron Mains and Their Appurtenances.
.12 ANSI/AWWA C604, Installation of Buried Steel Water Pipe – 4 In. (100 mm) and Larger.
.13 ANSI/AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
.14 ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. through 12 In. (100 mm through 400 mm) for Water Transmission and Distribution.
.15 ANSI/AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) through 3 In. (76 mm) for Water Service.
.16 ANSI/AWWA C905, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. through 48 In. (350 mm through 1,200 mm).
.17 ANSI/AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) through 65 In. (1,600 mm) for Water Distribution and Transmission,
.18 ANSI/AWWA C907, Injection-Moulded Polyvinyl Chloride (PVC) Pressure Fittings, 4 In. through 12 In. (100 mm through 300 mm) for Water, Wastewater, and Reclaimed Water Service.
.19 AWWA M55, PE Pipe – Design and Installation.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
.2 ASTM C478M, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections (Metric).
.3 ASTM D450, Standard Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing.
.4 ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves Testing, Woven Wire.
.2 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.
.3 CGSB41-GP-25M, Pipe, Polyethylene, for the Transport of Liquids.

.4 Canadian Standards Association (CSA)

.1 CSA-A82.56M, Aggregate for Masonry Mortar
.2 CSA-A3000, Cementitious Materials Compendium
.3 CAN/CSA-B137.0, Definitions, General Requirements, and Methods of Testing for Thermoplastic Piping.
.4 CAN/CSA-B137.1, Polyethylene (PE) Pipe, Tubing and Fittings for Cold Water Pressure Services.
.5 CAN/CSA-B137.2, Polyvinyl Chloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications.
.6 CAN/CSA-B137.3 Rigid Polyvinyl Chloride (PVC) Pipe and Fittings for Pressure Applications.
.7 CSA C22.2 No. 38, Thermoset Insulated Wires and Cables
.8 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement
.9 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles
.10 CAN/CSA Z245.1, Steel Pipe
.11 CAN/CSA Z245.21, Plant-Applied External Polyethylene Coating for Steel Pipe

1.2 SUBMITTALS

.1 Submit samples in accordance with Section 1 04 00 - Submittal Procedures.

.2 Inform Owner’s Representative at least 4 weeks prior to commencing work, of proposed source of bedding materials and provide access for sampling.

.3 Submit to Owner’s Representative for testing at least 2 weeks prior to commencing work, samples of materials proposed for use.

.4 Submit manufacturer's test data and certification at least 2 weeks prior to commencing work.

1.3 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Notify Owner's Representative and private property owner a minimum of 24h in advance of any interruption in service.

2 Products

2.1 MATERIALS

.1 Polyvinyl chloride (PVC) pressure pipe:

.1 Pressure class/rating as shown in the Bid Form and on the drawings.

.2 AWWA C900, DR 18 pressure class, gasket bell end, cast iron outside diameter (CIOD), for 100 mm to 300 mm in diameter; AWWA C905, DR 25 pressure rating, gasket bell end, cast iron and iron pipe outside diameter (CIOD and IPS), for 400 mm diameter and larger; CAN/CSA-B137.3

.3 Pipe marking: to CAN/CSA B137.0.

.4 Joint lubricants must be certified for use on PVC pipe.

.5 Supply an affidavit of Compliance to the AWWA C900 or C905 standard.

.6 Fabricated fittings: conform to CSA B137.3, fabricated from AWWA C900 PVC bonded and overwrapped with fibreglass reinforced polyester.

.7 PVC fitting (moulded): conform to AWWA C907 and certified to CSA B137.2.

.8 Ductile iron fittings: to ANSI/AWWA C110/A21.10, and for pipe diameters larger 300 mm.

.2 High Density Polyethylene (HDPE) pressure pipe:

.1 Pressure Class DR 11 (DR rating) unless otherwise shown on Bid Form or on drawings.

.2 HDPE pipes: to AWWA C906, CAN/CSA B137.1, PE 3608 or PE 4710 based on IPS outside diameter (100 mm through 1650 mm); to AWWA C901 for pipe 13 mm through 76 mm.

.3 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D 2657.

.4 Ductile iron fittings with flanged ends: to AWWA C110/A21.10 for pipe size above 100 mm.

.5 Polyethylene fittings: to CAN/CSA B137.1 or AWWA C901. Ductile iron backup flange to Class 150, ANSI B16.1/16.5 with stainless steel bolts and nuts, with neoprene or red rubber gasket.

.3 Steel Pipe

.1 Pipe: to AWWA C200, ASTM A53 Grade B

.2 Pipe marking (each pipe): to CSA Z245.1.

.3 Field welding: Butt weld to AWWA C206

.4 Exterior finish:

.1 CSA Z245.21 yellow jacket.

.5 Interior finish:

.1 AWWA C210 liquid Epoxy coating;

.2 AWWA C213 Fusion Bonded Epoxy Coating.

.6 Pipe joints: to be butt welded joints. Prepare in accordance to AWWA C206.

2.2 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to Section 3 04 00 – Aggregate Materials and following requirements:

Acceptable Bedding Material Gradation	
	% Passing
10,000	100
5,000	50 – 100
2,000	30 – 90
400	10 – 50
80	0 – 10

.2 Concrete required for cradles, encasement, supports, thrust blocks, all to Section 3 02 30 - Cast-in-Place Concrete.

2.3 BACKFILL MATERIAL

.1 Backfill in accordance with Section 2 01 00- Excavating, Trenching and Backfilling, and Section 3 04 00 – Aggregate Materials.

.2 Unshrinkable fill in accordance with Section 2 01 00 - Excavating, Trenching and Backfilling.

2.4 VALVES AND VALVE BOXES

.1 Plug Valve

.1 All plug valves shall be installed so that the direction of flow through the valve is in accordance with the manufacturer's recommendations.

.2 Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans, unless otherwise approved by the Owner’s Representative. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall meet AWWA C111, Class B. Cast iron valve boxes

.3 Valve bodies shall be of ASTM A126, Class B Semi-steel, 31,000psi tensile strength minimum in compliance with AWWA C507 or C504. All exposed nuts, bolts, springs, washers, etc. shall be stainless steel. Resilient plug facings shall be Neoprene.
.4 Port areas for valves 100mm through 500 mm shall be 80 percent nominal pipe diameter. Valves 600mm and larger shall have a minimum port area of 70 percent of nominal pipe diameter. All exposed nuts, bolts, springs, washers, etc., shall be stainless steel. Resilient plug facings shall be Neoprene.
.5 Valves shall be furnished with permanently lubricated stainless steel or oil-impregnated bronze upper and lower plug stem bushings. These bearings shall comply with AWWA C507 or C504
.6 Seats in 100mm and larger valves shall have a welded-in overlay of a high nickel content on all surfaces contacting the plug face which comply with AWWA C507 or C504.
.7 Plug valves shall be tested in accordance with AWWA C504. Each valve shall meet the performance, leakage, and hydrostatic tests described in AWWA C504. The leakage test shall be applied to the face of the plug tending to unseat the valve. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in AWWA C504.

.2 Valve box

.1 Epoxy coated two-piece cast iron sliding type adjustable over a minimum of 450 mm, 50 mm top operating nut with stone catcher flange, complete with valve operating extension rod, 25 x 25 mm cross section, of such length that when set on valve operating nut top of rod will not be more than 300 mm below cover. Base to be large round type with minimum diameter of 184 mm. Top of box to be marked "WATER" with cored handholes.
.2 Depth of bury: 3.5 m to top of pipe (min).
.3 Type: Norwood Type A.
.4 PVC valve boxes are not approved.

.3 Air Release/Vacuum valve

.1 Conform to AWWA C512 - 13 mm through 150 mm air-release valves and 13 mm though 500 mm air/vacuum and combination air valves having Type 304 or 316 stainless steel body.

.2 Flanged ends dimensions and drilling shall conform to ANSI/ASME B16.1, Class 125 or Class 250 except all flanges shall be flat faced unless otherwise specified.

.3 Threaded end connections shall conform to the specifications for tapered pipe threads for general use, National Pipe Threads (NPT) per ANSI/ASME B1.20.1.

.4 Floats for valves with inlet sizes less than 100 mm shall be capable of withstanding a collapse pressure of 6,900 kPa. For 100 mm and larger, shall be capable of withstanding collapse pressure of 5,180 kPa.

.5 Gaskets shall be made of rubber composition that is free of asbestos or corrosive ingredients. O-rings or the suitable elastomeric seals may be used for

gaskets. O-rings shall be compounded to meet ASTM D450 and has physical properties suitable for the application.

.6 An air release valve and an air/vacuum valve assembled with inter-connecting pipes shall have pipe fittings of sufficient size to prevent clogging and entrapment of foreign materials. The piping between the air/vacuum valve and the air-release valve be installed to allow air to rise to the air-release inlet. A shutoff valve isolating the two valves shall be installed.

.7 Inlet and outlet ports for air/vacuum valves and combination air valves shall be sized to ensure that the minimum flow area of each port shall be equal to or greater than the flow area of a circle of diameter equal to the nominal valve size.

2.5 VALVE CHAMBER

.1 Concrete and reinforcing steel: to Section 3 02 30 - Cast-in-Place Concrete and Section 3 02 20 - Concrete Reinforcement.

.2 Precast concrete sections to ASTM C 478M. Ladder rungs to be cast integral with unit; field installation not permitted. Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation. Monolithic bases to be approved by Engineer and set on concrete slabs cast in place.

.3 Valve chamber frames and covers: gray iron castings, minimum tensile strength 200 MPa, with two coats, shop applied, approved asphalt coating. Design and dimensions to be as indicated. Cover to be marked "SEWER". Manhole frame and covers: type as indicated on drawings. All joints to be water tight and sealed with cement mortar on interior and exterior of manhole.

.4 Jointing materials:

- .1 Manufacturer's rubber ring gaskets.
- .2 Mastic joint filler.
- .3 Cement mortar.
- .4 Combination of above types.

.5 Mortar: aggregate to CSA A82.56, cement to CAN/CSA-A3000.

.6 Ladder rungs for valve chambers: 20 mm diameter deformed rail steel bars to CAN/CSA-G30.18, hot-dipped galvanized after fabrication to CAN/CSA-G164. Rungs to be safety pattern.

.7 Adjusting rings: to ASTM C478M

2.6 ZINC ANODES (FOR BURIED VALVES, METAL FITTINGS, AND COUPLINGS)

.1 Zinc anodes: to ASTM B418 Type II with the following composition:

- .1 Aluminum 0.005%
- .2 Cadmium 0.003%

.3	Iron	0.0014%
.4	Copper	0.002%
.5	Zinc	Remainder

.2 Lead Wire No.: 10 AWG, 3 m long to CSA C22-2 No.38.

.3 Minimum size; 5.5 kg.

.4 Conductivity strip used for bonding across couplings, valves, etc. shall be #4 AWG, stranded copper conforming for CSA C22-2 No.38.

2.7 CORROSION PROTECTION

.1 In addition to anode protection and provision of test stations and conductivity strips, all buried nuts, bolts, transition couplings, restrainers and metal fittings to be coated with Denso Mastic and Denso Tape.

.2 Any alternate corrosion protection methods are to be approved by the Owner's Representative.

3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation. Inspect materials for defects before installing. Remove defective materials from site.

3.2 TRENCHING

.1 Do trenching and backfill work in accordance with Section 2 01 00 - Excavating Trenching and Backfilling.

.2 Do not allow contents of any sewer or sewer connection to flow into trench.

.3 Trench line and depth require approval prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

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

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% SPD.

3.4 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.4 Place layers uniformly and simultaneously on each side of pipe

.5 When field test results are acceptable to owner’s representative place surround material at pipe joints.

.6 Compact each layer from pipe invert to underside of backfill to at least 95 % SPD.

3.5 INSTALLATION

.1 Lay pipes in accordance with manufacturer's recommendations.

.2 Join pipes in accordance with manufacturer's recommendations.

.3 Avoid damage to machined ends of pipes in handling and moving pipe.

.4 Maintain grade and alignment of pipes.

.5 Align pipes carefully before jointing.

.6 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.7 Support pipe firmly over entire length, except for clearance necessary at couplings. Do not use blocks to support pipe.

.8 Keep pipe and pipe joints free from foreign material.

.9 Avoid bumping gasket and knocking it out of position or contaminating with dirt or other foreign material. Gaskets so disturbed to be removed, cleaned, lubricated, and replaced before jointing is attempted.

.10 Support pipes by means of hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.11 Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.

.12 Apply restraint to pipe to ensure that joints when completed are held in place, by tamping fill material under and alongside pipe, or otherwise as approved by Owner’s Representative.

.13 When any stoppage of work occurs, block pipe as directed by Owner's Representative to prevent creep during downtime.

3.6 THRUST BLOCKS

.1 Restrain bends, tees and fittings by concrete thrust blocks as indicated on drawings.

.2 Keep pipe couplings free of concrete.

.3 Bearing area of thrust blocks to be as indicated.

3.7 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.4 Place layers uniformly and simultaneously on each side of pipe

.5 When field test results are acceptable to Owner's Representative place surround material at pipe joints.

.6 Compact each layer from pipe invert to underside of backfill to at least 95 % SPD.

3.8 BACKFILL

.1 Place backfill in accordance with Section 2 01 00 - Excavating, Trenching and Backfilling.

.2 Unshrinkable fill: to Section 2 01 00 - Excavating, Trenching and Backfilling.

.3 Complete field density testing around valves, valve chambers, and vaults in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling.

3.9 UNDERCROSSING

.1 For Horizontal Directional Drilling (HDD), refer to Special Provision.

.2 For Augered Crossing, refer to Section 2 09 00 – Augured Crossings.

.3 For Microtunneling, refer to Special Provision.

3.10 HYDROSTATIC AND LEAKAGE TESTING

.1 Both a hydrostatic pressure test and a leakage test to be performed. Do tests in accordance with:

.1 AWWA C605 for PVC pipe.

.2 AWWA C600 for ductile iron pipe.

.3 AWWA M55 and ASTM F2164 for HDPE pipe.

.4 AWWA C604 for steel pipe.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.3 Arrange, pay and coordinate supply of water for hydrostatic and leakage testing. Owner will pay for volume of water required for up to 3 complete fillings of pipeline.

.4 Notify Owner's Representative at least 24 h in advance of all proposed tests. Contractor to confirm that test sections will maintain pressure prior to Owner's Representative being on-site. Perform all subsequent tests in presence of Engineer.

.5 Where any section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.6 Test pipeline in shortest possible segments (between valves), unless otherwise authorized by Owner's Representative.

.7 Pipe will be tested only after complete backfilling of trench.

.8 Leave valves, joints and fittings exposed.

.9 No testing is allowed during freezing weather, unless approved by the Owner's Representative. In such case, the Contractor shall protect valves, joints and fittings, ditch, road surface and including the test area free from ice.

.10 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.11 Open valves.

.12 Expel air from the pipe by slowly filling the pipe with water. Install corporation stops at any high points in the pipe where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.

.13 Fill and pressurize PVC, steel, and HDPE pipes before test to allow for any expansion and stretching.

.14 The hydrostatic pressure test to be performed at 1.5 times design working pressure based on elevation of lowest point in main and corrected to elevation of test gauge, for the duration specified in item 3.10.17 in this Section.

.15 Remove any pipe, fittings and appurtenances found defective and replace with new sound material and make watertight.

.16 Repeat hydrostatic test until all defects have been corrected. Contractor is responsible for all costs on repeat tests.

.17 The hydrostatic pressure test procedure is as follows:

.1 Allow hydrostatic pressure to stand for 1 hour, re-pressurize as required after 1 hour to return to test pressure.

.2 Repeat for up to a maximum of 4 hours.

.3 If pressure continues to drop after 4 hours, to below 90% of the test pressure, the hydrostatic pressure test is deemed to have failed.

.4 Relax the test pressure on the pipeline and let stand for a minimum of 12 hours.

.5 The hydrostatic pressure test is to be repeated until the pressure drop after 1 hour is less than 35 kPa. The leakage test may then be performed.

.18 The leakage test for PVC is to be performed. To pass the leakage test, the volume of makeup water must not exceed the calculated volume of allowable makeup water as per the following tables.

Allowable Makeup for PVC Plastic Pipe with Elastomeric Joints

(Litres per Hour)

Nominal Pipe Size *mm)	345 kPa (50 psi)	690 kPa Average Test (100 psi)	1035 kPa Pressure (150 psi)	1380 kPa (200 psi)
	Allowable Makeup Per 50 Joints (305m)			
100	0.72	1.02	1.25	1.44
150	1.10	1.55	1.89	2.16
200	1.44	2.04	2.50	2.88
250	1.82	2.57	3.14	3.63
300	2.16	3.07	3.75	4.35
350	2.54	3.60	4.39	5.07
400	2.88	4.09	5.0	5.79
450	3.26	4.62	5.64	6.51
500	3.63	5.11	6.28	7.23
600	4.35	6.13	7.53	8.67
750	5.41	7.68	9.39	10.86
900	6.51	9.20	11.28	13.02

.19 For HDPE pipe, allow for initial pipe expansion before initiating the hydrostatic test:

.1 During the expansion phase, when the test section is filled and purged of air, gradually increase pressure in the test section to the required test pressure.

.2 If the test pressure cannot be attained, or if it takes an unreasonably long time to reach test pressure, there may be faults such as excessive leakage or entrapped air etc. If faults exist, discontinue pressuring, and correct them before continuing.

.3 Add make-up water as necessary to maintain maximum test pressure for 4 hours.

.4 During the test phase, reduce test pressure by 69 kPa (10 psi) and monitor the pressure for 1 hour. (Do not increase pressure or add make-up water).

.5 If no visual leakage is observed, and pressure during the test phase remains steady (within 5% of the test pressure) for the 1-hour test phase period, a passing test is indicated.

.6 If the test including the time required to pressurize, stabilize, hold test pressure and depressurized is not completed due to leakage or any other reason within 8 hours, the test section should be permitted to relax for at least 8 hours before repeating the test.

.20 For Steel Pipe:

.1 The pipe shall hold the test pressure for 2 hours.

.2 There should be no leakage in all-welded pipeline.

3.11 SWABBING AND FLUSHING

.1 Contractor shall submit a swabbing and flushing plan at least 4 weeks in advance of proposed date when swabbing and flushing operations will commence.

.2 Swabbing and flushing operations shall be witnessed by Owner’s Representative.

.3 Contractor is responsible to arrange, and coordinate water for testing, swabbing, flushing and temporary operation.

.4 The Owner will supply a maximum of three times the pipeline volume used.

.5 Swabbing:

.1 All pipes are to be swabbed.

.2 Each pipe shall be swabbed with a minimum 4 swabs, two scrubbing swabs (pigs) and two foam swabs (pigs). Each swab is to be launched at a short interval. Swabs shall be medium density urethane bullet type and shall have a diameter of at least 50 mm larger than the largest pipe nominal diameter.

.3 Pipe shall be filled with water before launching the first swab.

.4 After the first swab has been launched, continue pumping until the swab has travelled at least 30 metres or five (5) minutes, launch the second swab. Continue to launch the third and fourth swabs with the same intervals.

.5 Continue to flush the line for five (5) minutes after the fourth swab has been retrieved.

.6 Contractor to supply and install temporary launches and retrievers to facilitate swabbing. Contractor to remove these items following the completion of the swabbing.

.7 Provide connections and pumps for swabbing as required.

3.12 SURFACE RESTORATION

.1 After installing and backfilling over the force mains, restore surface to original condition as directed by the Owner's Representative.

4 Measurement and Payment

4.1 Sanitary Force Main

.1 Sewage Force Main pipe shall be measured and paid for by the meter for the sizes indicated in the bid form. Measurements shall be taken along the centerline of the installed pipe accepted by the owner's representative. Price to include all materials, thrust blocking, fittings, joint restraints, cathodic protection, tracer wire, testing, swabbing, flushing, and commissioning, labour, equipment, supervision and incidentals required to install the pipe as per the specifications.

.2 Refer to Excavating, Trenching and Backfilling section for measurement of trenching and backfilling depth within a roadway or greenfield.

.3 No separate payment will be paid for swabbing, cleaning, flushing, and testing.

4.2 Valves and Valve Chambers

.1 Supply and installation of valves and valve chambers will be measured in each unit of each size, and type of valve installed, as shown in the Bid Form.

.2 Unit price to include the supply of valve, manhole material, frame and cover, installation of valve, valve stem extension to surface, valve box, fittings, piping, bedding, thrust blocking, cathodic protection, valve box final grade adjustment and all work incidental thereto to the limits indicated on the drawings.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C 14M, Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe.
.2 ASTM C 76M, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
.3 ASTM C 443M, Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3).
.5 ASTM D 3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
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.6 ASTM F 667, Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings.
.7 ASTM F 794, Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CSA-A3000, Cementitious Materials Compendium
.2 CAN/CSA-A257 Series, Standards for Concrete Pipe.
.3 CAN/CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.
.4 CSA-B182.2, PVC Sewer Pipe and Fittings (PSM Type).
.5 CSA-B182.4, Profile PVC Sewer Pipe and Fittings.
.6 CSA B182.8, Profile Polyethylene (PE) Storm Sewer and Drainage Pipe and Fittings.
.7 CSA B182.13, Profile Polypropylene (PP) Sewer Pipe and Fittings for Leak-Proof Sewer Applications.

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 1 04 00 - Submittal Procedures.

.2 Shop drawings to indicate proposed method for installing carrier pipe for undercrossing.

.3 Inform Owner’s Representative at least 4 weeks prior to commencing work, 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.

1.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Maintain existing flow during construction.

.3 Submit schedule of expected interruptions for approval and adhere to approved schedule.

2 Products

2.1 CONCRETE PIPE

.1 Reinforced circular concrete pipe and fittings: to CAN/CSA-A257, minimum Class III for 300mm diameters and up designed for flexible rubber gasket joints to CAN/CSA A257.

.2 Pipe shall be jointed with rubber gasketed fittings or couplings.

.3 Concrete to be made with Type 50 Portland cement.

.4 Lifting holes:

.1 Pipe 900mm and less diameter: no lift holes.

.2 Pipe greater than 900mm diameter: lift holes not to exceed two in piece of pipe.

.3 Provide prefabricated plugs to effectively seal lift holes after installation of pipe.

2.2 CORRUGATED STEEL CULVERTS

Corrugated steel pipe and couplers: to Section 2 07 00 – Pipe Culverts

2.3 PLASTIC PIPE

.1 Type Poly Vinyl Chloride (PVC): to ASTM D 3034 & CSA-B182.2.

.1 100mm to 1500mm diameters.
.2 Standard Dimensional Ratio SDR 35.
.3 Minimum Pipe Stiffness 320 kPa.
.4 Locked-in gasket and integral bell system.
.5 Nominal lengths: 4 or 6 m.
.6 PVC open profile sewer pipe and fittings: to CSA B182.4 for diameters 200mm to 1500mm.

2.4 HIGH DENSITY POLYETHYLENE PIPE OPEN PROFILE

.1 Corrugated polyethylene pipe: high density to CSA B182.8 for 100mm to 900mm diameters.

2.5 POLYPROPYLENE PIPE

.1 Polypropylene Pipe to CSA B182.13 with minimum pipe stiffness 320 kPa for 100mm to 1500mm diameter.

2.6 PIPE ZONE AND SURROUND MATERIAL

.1 Refer to Section 3 04 00 – Aggregate Materials.

.2 Bedding material shall be Class B sand bedding.

Acceptable Bedding Material Gradation	
	% Passing
10,000	100
5,000	50 – 100
2,000	30 – 90
400	10 – 50
80	0 – 10

.3 In high water table areas with poor soils, course granular or washed rock shall be used.

.4 Concrete mixes and materials for bedding, cradles, encasement, supports to Section 3 02 30 - Cast-in-Place Concrete.

2.7 BACKFILL MATERIAL

.1 Section 2 01 00 - Excavating Trenching and Backfilling

.2 Unshrinkable fill: to Section 2 01 00 - Excavating, Trenching and Backfilling

2.8 JOINT MORTAR

.1 Portland cement: to CAN3-A3000 normal type 50.

.2 Mortar to consist of one part Portland cement to two parts clean sharp sand mixed with minimum amount of water to obtain optimum consistency for use intended. Do not use additives.

3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.2 TRENCHING

.1 Do trenching and backfill work in accordance with Section 2 01 00 - Excavating, Trenching and Backfilling.

.2 Do not allow contents of any sewer or sewer connection to flow into trench.

.3 Trench line and depth require approval by owner's representative prior to placing bedding material and pipe.

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete work in accordance with Section 3 02 30 - Cast-in-Place Concrete. Place concrete to details as indicated or directed by owner's representative.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 hours after placing.

3.4 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

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

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95 % corrected maximum dry density maximum density to ASTM D 698.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with lean mix concrete.

3.5 INSTALLATION

.1 Confirm all inverts prior to commencement of construction.

.2 Lay and join pipe in accordance with manufacturer's recommendations.

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

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

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

.6 Lay corrugated steel pipe:

.1 With outside circumferential laps facing upgrade and longitudinal laps or seams at side or quarter points.

.2 With longitudinal centre line of paved invert coinciding with flow line

.7 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.8 Do not allow water to flow through pipes during construction except as may be permitted by owner’s representative.

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

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

.11 Joints:

.1 Install gaskets as recommended by manufacturer.

.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 contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace 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 At rigid strictures, install pipe joints not more than 1.2m from side of structure.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.12 When any stoppage of work occurs, block pipes as directed by Owner's Representative, to prevent "creep" during down time.

.13 Plug lifting holes with owner's representative approved prefabricated plugs, set in non-shrink grout.

.14 Cut pipes as required for special inserts, fittings, or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

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

.16 Contractor to verify specified pipe slope as indicated for each section of pipe. Any pipes not meeting the required minimum design slope are to be replaced at no cost to the Owner.

.17 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.

.18 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel, or wooden bulkheads.

3.6 PIPE SURROUND

.1 Prior to installing pipe, a layer of pipe zone material shall be placed as bedding in the trench bottom and compacted to grade by approved hand tampers or mechanical means to form a firm pipe base. This cushion shall cover the full width of the trench bottom and have a minimum depth as shown on details on completion of compaction.

.2 Place pipe bedding as shown on drawings.

.3 In rock excavation, the minimum depth of bedding below the pipe shall be 150 mm.

.4 Bell or coupling holes shall be dug such that the full barrel of the pipe is supported throughout its length by the bedding material.

.5 Place pipe zone material in unfrozen condition.

.6 Upon completion of pipe laying, and after owner's representative has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.7 Place pipe zone material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.8 Place layers uniformly and simultaneously on each side of pipe.

.9 Compact each layer from top of bedding to underside of backfill to at least 95% of Standard Proctor.

.10 When field test results are acceptable to owner's representative, place pipe zone material at pipe joints.

3.7 SERVICE CONNECTIONS

.1 Install pipe to CSA B182.11 and manufacturer's standard instructions and specifications.

.2 Install storm services to vacant or un-serviced properties as per direction from Owner's Representative.

.3 For service connection details, see Standard Details 5-500 and 5-501.

.4 Storm sewer service connections for commercial, industrial, multi-family or institutional areas, unless otherwise approved by the Municipality, will only be made after the service requirements have been determined and a permit, approving the installation, is issued by the Municipality.

.5 Storm sewer service connections are to be installed as a single connection from the main to the property line in common trench with water and sanitary service.

.6 If there is an easement for shallow utilities adjacent to the road right-of-way, the service connection shall be 1m beyond the limits of the shallow utility easement.

.7 All storm sewer service connections should be installed with a minimum 1.0% slope and with a minimum cover of 2.0 m at the property line.

.8 Storm sewer service connection materials shall be polyvinyl chloride (PVC) DR28 building service pipe conforming to CSA specification B182.2, latest revision thereof.

.9 Service connections shall be made using in-line tee and shall not be connected to manholes. Exceptions will be clearly noted in the Construction Drawings and Contract Specifications.

.10 Pipe saddles or inserta tees shall be used to connect storm sewer services to mains in instances where retrofit work is undertaken.

.11 The end of the sewer service connection shall be adequately capped or plugged to prevent the entry of soil, water, or other deleterious material into the pipe. The end of the pipe shall be marked by a vertical, nominal size 2" x 4" timber set at the service invert and extending 1m above the top surface of the surrounding ground. The top 300mm of the exposed portion of this marker shall be painted red.

.12 Service connection pipe: not to extend into interior of main sewer.

.13 Make up required horizontal and vertical bends from 45° bends or less, separated by straight section of pipe with minimum length of four pipe diameters. Use long sweep bends where applicable.

.14 Plug service laterals with watertight caps or plugs as approved by Owner's Representative.

.15 Service connections to extend 1.0 m beyond easement line.

3.8 BACKFILL

.1 Place backfill in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling.

.2 Do not place backfill in frozen condition.

.3 Compact backfill material in accordance with section 3 04 00 – Aggregate Materials and 2 01 00 – Excavating Trenching and Backfilling.

3.9 UNDERCROSSING

.1 For Augered Crossing, refer to Section 2 09 00 – Augured Crossings.

.2 For Microtunneling, refer to Special Provision.

3.10 QUALITY CONTROL

.1 The Contractor shall provide all materials, equipment, labour and supervision necessary, and shall carry out inspections on the sewers in accordance with the specifications in the presence of the Owner's Representative.

.2 Variation in line or grade of pipe from that identified in the drawings prior to installation, and any improper jointing, pipe cleaning, or other deficiencies discovered shall be rectified.

.3 Exfiltration test:

.1 Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are commenced.

.2 Immediately prior to test period add water to pipeline until there is a head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static ground water level, whichever is greater.

.3 Duration of exfiltration test: 2 hours.

.4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.

.4 Infiltration test:

.1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 1 meter or more above top of pipe measured at highest point in line to be used.
.2 Install watertight plug at upstream end of pipeline test section.
.3 Discontinue pumping operations for at least 3 days before test measurements are to commence and during this time, keep thoroughly wet at least one third of pipe invert perimeter.
.4 Prevent damage to pipe and bedding material due to flotation and erosion.
.5 Place 90º V-notch weir, or other measuring device approved by owner's representative in invert of sewer at each manhole.
.6 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.

.5 Infiltration and exfiltration: not to exceed following limits in L per hour per 100 m of pipe, including service connections.

Nominal Pipe Diameter in mm	**Plastic Pipe[1]**	**Concrete pipe[2]**
100	1.91	9.32
125	2.39	11.65
150	2.88	13.98
200	3.83	18.64
250	4.79	23.3
300	5.75	27.96
350	6.71	32.62
400	7.67	37.28
450	8.63	41.94
500	9.58	46.6
550	10.54	51.26
600	11.5	55.93
700	13.42	65.24
800	15.33	74.57
900	17.25	83.89

1000	19.17	93.21
1100	21.12	102.53
1200	23.04	111.85

Notes: (1) Uni-Bell Handbook – 4.6 1/mm of diameter/km/day

(2) Concrete Pipe Handbook – 22.37 1/mm of diameter/km/day

.6 Values shown in columns 2 and 3 are in litres per hour per 100 metres of pipe.

.7 Repair and retest sewer lines as required, until test results are within limits specified.

.8 Contractor to supply and disposed of all the water required for the tests.

.9 Repair visible leaks regardless of test results.

.10 Deflection Testing:

.1 Following owner's representative review of CCTV Inspection report of all new PVC Sewers 200mm diameter or larger, perform Mandrel tested as requested by Owner's Representative.

.2 The Mandrel will be of cylindrical shape, with the minimum length of the cylinder 1.5 times the diameter and a minimum outside diameter not less than 95% of the inside diameter of the sewer.

.3 The Mandrel will be pulled by hand through all sections of the sewer.

.4 The Mandrel material shall be steel.

.5 Deflection testing must be conducted within 30 days of pipe installation.

.6 If the Mandrel is unable to pass through the pipe, the contractor is to measure the exact inside diameter of the pipe with a deflectometer. If the pipe deflections are found to exceed 7.5%, the pipe is to be replaced.

.11 Repair and retest sewer line as required, until test results are within limits specified.

.12 Repair visible leaks regardless of test results.

.13 CCTV Video Inspection

.1 The sewer inspection method is image-based inspection. The following specifications will pertain to image-based inspection hardware, software, and output. Sewer inspections shall be performed to observe and record structural and service defects and construction features, to assess thoroughness of cleaning, and to verify new installation and rehabilitation work quality prior to acceptance. All observations shall be coded in accordance with the latest version of Pipeline Assessment & Certification Program (PACP) codes, and the findings shall be submitted in an inspection report consisting of a hardcopy data file and the original video recording (in digital format on CD-R, DVD, portable hard drive, or USB flash drive). Condition coding shall only be performed by operators who have either successfully attained PACP certification.

.2 All pipe up to and including 1200 mm diameter shall be inspected with image-based video inspection. Upon approval of the engineer, the exceptions to this inspection requirement include force mains, and catch basin leads. Pipe larger than 1200 mm diameter may be inspected and observations recorded during a walk-through by an operator with PACP certification, or by image based inspection where authorized by the Engineer.

.3 Perform inspection after all mains, manholes and service connections have been installed and backfilled.

.4 The camera transport shall permit complete inspection of the sewer from the centre of the start manhole to the centre of the finish manhole. The camera transport and cable shall inspect a minimum of 200 m of sewer from a single access point. A remote reading counter shall be used to measure distance traveled from the centre of the start manhole and measurements shall be recorded in metres to the nearest 100mm.

.5 The camera height shall be adjustable, to position the centre of the lens in the centre of circular sewers.

.6 Sewer Condition Reports The sewer condition shall be coded in accordance with the latest version of PACP codes. The sewer condition reports shall consist of a hardcopy data file and original video recording (in digital format on CD-R or DVD, portable hard drive, or USB flash drive.

.7 A television work report, in log form, shall be maintained during the inspection. This log shall show the exact location of each leak or fault discovered by the television - e.g., open joints, broken, cracked, or collapsed pipe, presence of grease, roots, debris, accumulation, obstructions, infiltration, water depth variations and other points of significance. The reference location shall include the distance away from the reference manhole and the position of the leak or fault as referenced to the crown of the pipe using clock face notation.

.8 The report shall include the location and photograph of all service connections together with a statement of opinion as to whether the service connections are leaking. Protrusions of the service connections into the mainline shall be noted with reference to the degree of protrusion.

.9 Still photographs of all sewer defects shall be taken. The photographs shall be coordinated with the written report by reference numbers. A minimum of one photograph per reach of sewer shall be taken to show a representative view of the workmanship, as well as additional photographs of deficiencies and service connections as required.

4 Measurement and Payment

4.1 STORM SEWER PIPE

.1 Storm sewer pipe shall be measured and paid for by the meter for the sizes indicated on the bid form. Measurements shall be taken along the centerline of the installed pipe accepted by the Owner's Representative.

.2 The unit price to include all materials, labour, equipment, supervision, fittings, plugs, tie-ins, and incidentals required to install the pipe as per the specifications.

4.2 STORM SERVICE PIPE

.1 Storm sewer service pipe shall be measured and paid for by the meter for the sizes indicated in the bid form. Measurements shall be taken along the centerline, including all fittings, of the installed pipe accepted by the Owner's Representative.

.2 The unit price to include all materials, labour, equipment, supervision and incidentals required to install the pipe as per the specifications.

4.3 INFILTRATION/EXFILTRATION TESTING

.1 If requested by the Owner's Representative, infiltration and/or exfiltration testing paid for upon completion.

.2 The lump sum unit price to include all materials, labour, equipment, supervision, flushing, cleaning, traffic control and incidentals required to complete the testing.

4.4 CCTV VIDEO INSPECTIONS

.1 CCTV video inspection shall be measured and paid for by the meter. Measurements shall be taken along the centerline of the installed pipe accepted by the Owner's Representative.

.2 The unit price to include all materials, labour, equipment, supervision, flushing, cleaning, traffic control and incidentals required to complete the video.

.3 No separate payment will be made for deflection/mandrel testing, if requested.

END OF SECTION

1 General

This Section specifies requirements for supplying and installing pipe culverts.

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials

.1 ASTM C14M, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe (Metric).

.2 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).

.3 ASTM C144, Standard Specification for Aggregate for Masonry Mortar.

.4 ASTM C443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA G401, Corrugated Steel Pipe Products

.2 CAN/CSA-A257, Standards for Concrete Pipe

.3 CSA-A3000, Cementitious Materials Compendium.

1.2 MATERIAL CERTIFICATION

.1 Submit manufacturer's test data and certification at least 4 weeks prior to commencing work.

.2 Certification to be marked on pipe.

2 Products

2.1 CORRUGATED STEEL PIPE

.1 Galvanized corrugated steel pipe (CSP) to CSA G401 and AASHTO M-36.

.2 Minimum wall thickness of 1.6 mm, or as required by loading criteria

.3 Provide watertight cut-off collars as indicated.

.4 Prefabricated end sections as indicated.

2.2 CONCRETE PIPE

.1 Non-reinforced concrete pipe: to CAN/CSA-A257, ASTM C 14M, diameter and Class as indicated.

.2 Reinforced concrete pipe: to CAN/CSA-A257, ASTM C 76M, diameter and strength classification as indicated.

.3 Rubber gaskets for joints: to CAN/CSA-A257, ASTM C 443M.

.4 Cement mortar joint filler:

.1 Portland cement: to CAN/CSA A3000, type 10.

.2 Sand: to ASTM C 144.

.3 Mortar: one part by volume of cement to two parts of clean, sharp sand mixed dry. Add sufficient water after mixing to give optimum consistency for hand application.

2.3 GRANULAR BEDDING

.1 Granular bedding material to Section 3 04 00 – Aggregate Materials

2.4 RIP—RAP

.1 To Section 3 15 00 – Rip-Rap

2.5 GEOTEXTILE FABRIC

.1 Non-woven geotextile fabric as per Section 03 05 30 - Geotextiles

3 Execution

3.1 TRENCHING, BEDDING AND BACKFILL

.1 Do trenching, bedding and backfill work to Section 2 01 00 – Excavating, Trenching and Backfilling.

.2 Trench line and grade as established by Owner’s Representative.

.3 Do not backfill until pipe grade and alignment is inspected by Owner’s Representative.

3.2 LAYING CORRUGATED STEEL PIPE CULVERTS

.1 Commence pipe placing at downstream end.

.2 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.

.3 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.4 Do not allow water to flow through pipes during construction except as permitted by Owner’s Representative.

3.3 JOINTS: CORRUGATED STEEL PIPE

.1 Match corrugations or indentations of coupler with pipe sections before tightening.

.2 Tap couplers firmly as they are being tightened to take up slack and ensure a snug fit.

.3 Insert and tighten bolts.

3.4 LAYING CONCRETE PIPE CULVERTS

.1 Begin at downstream end of culvert with female end of first pipe section facing upstream.

.2 Ensure barrel of each pipe is in contact with shaped bed throughout its length.

.3 Do not allow water to flow through pipes during construction except as permitted by Owner’s Representative.

3.5 JOINTS: CONCRETE PIPE CULVERTS

.1 Joints may be made with rubber gaskets, bituminous jointing compound or Portland cement mortar where specific joint type is not otherwise specified.

.1 Rubber gasket joints:

.1 Install to manufacturer's recommendations.

.2 Ensure that male ends are fully entered into female ends.

.2 Bituminous filled joint:

.1 Make joint with an excess of filler to form continuous bead around outside of pipe and finish smooth on inside.

.3 Mortar joints:

.1 Prepare mortar as specified herein.

.2 Clean pipe ends and wet with water before joint is made.

.3 Place mortar in lower half of female end of pipe section in place.

.4 Apply mortar to upper half of male end of pipe section being installed.

.5 Join pipe ends and force joint up tight, taking care to ensure inner surfaces of abutting pipe sections are flush and even.

.6 Clean inside of pipe and annular space between ends of pipes after each joint is made.

.7 Fill joint with mortar and finish smooth and even.

.8 For pipes 800 mm or less diameter, fill joints before mortar in joints has set.

.9 For pipes over 800 mm diameter, postpone filling joint until backfilling has been completed. Re-clean joints before applying mortar.

3.6 RIP-RAP

.1 Install rip rap at both ends of culvert as detailed.

.2 Grade and level the slopes to receive the rip rap. Lay geotextile fabric on the slopes anchored at the top.

.3 Place rock in a staggered manner to form a running bond pattern on each layer and between layers. Remove foreign matter from rock surfaces during placement. Rip rap face shall appear closely packed and uniform.

.4 Where required install trash rack as detailed on the drawings.

4 Measurement and Payment

4.1 PIPE CULVERTS

.1 Supply and installation of pipe culvert including surface restoration will be measured in metres in place for each size, type, and class of pipe. No separate measurement will be made for couplings, fittings, and collars for pipe culverts.

.2 The unit price for supply and installation will include any necessary dewatering prior to placing of bedding and construction maintenance and removal of any temporary bypass roads.

END OF SECTION

1 General

This section specifies requirements for supplying and installing sub-drain systems for roadways or other specified applications.

2 Products

2.1 PIPE

.1 Perforated PVC pipe PERF SDR 35 or approved equal and shall meet the following requirements:

.1 CAN3-B182.2 and ASTM D3034.

.2 Perforations shall consist of two rows of 14 mm holes positioned at 120 degrees radially and spaced to provide a minimum total cross sectional hole area of 3000 mm^2 per metre of length.

.3 Pipes shall be fit with friction fit bell ends.

.2 Perforated corrugated steel pipe to meet the following requirements:

.1 CAN3-G-401.

.2 Galvanized.

.3 Metal thickness unless otherwise indicated:

Diameter	Thickness of Metal
150 to 200 mm	1.2 mm
250 to 300 mm	1.6 mm

2.2 GRANULAR FILTER MATERIAL

.1 Screened rock to Section 3 04 00 – Aggregate Materials.

2.3 GEOTEXTILE FABRIC

.1 Geotextile fabric to Section 3 05 30 – Geotextiles.

.2 Geotextile fabric sleeve: Nilex Nu-Drain

3 Execution

3.1 TRENCHING

.1 Do trenching and backfilling work to Section 2 01 00 – Excavating, Trenching and Backfilling.

.2 Trench line and depth as established by Owner's Representative.

3.2 BEDDING

.1 Trim drain bed to given elevations.

.2 Correct over excavation with approved material compacted to not less than 100% of Standard Proctor Density.

3.3 INSTALLATION

.1 Drape filter cloth material in trench.

.2 Place minimum of 75 mm of screened rock on trench bottom.

.3 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.

.4 Commence laying at outlet and proceed in upstream direction.

.5 Wrap pipe with geotextile fabric or insert pipe in geotextile sleeve as shown on the drawings as directed by the Owner's Representative.

.6 Lay perforated pipes with perforations downwards.

.7 Make joints in accordance with manufacturer's specifications.

.8 Do not allow water to flow through pipes during construction except as approved.

.9 Place filter rock over drainage pipe to the depth shown in contract drawings.

.10 Wrap filter material around top of filter rock. Ensure ends overlap a minimum of 300 mm.

.11 Protect subdrains against floatation during installation.

.12 Connect subdrains to manhole as indicated.

3.4 BACKFILLING

.1 Do not backfill until system is inspected by Owner's Representative. Contractor is responsible, at their cost, to expose any work which has been backfilled and has not been inspected or approved.

.2 Backfill with specified material using hand tampers.

4 Measurement and Payment

.1 Subdrains to be measured in lineal metres, including drainage pipe, filter fabric sock, filter rock and surrounding filter fabric.

.2 Trenching and backfilling to be paid under Section 2 01 00 – Excavating, Trenching and Backfilling.

END OF SECTION

1 General

1.1 SCOPE

.1 This section specifies the requirements for the installation of pipes referred to as "carrier pipe", under designated rights-of-way be means of auger boring.

1.2 REGULATIONS

.1 Regulations of the Board of Transportation Commissioners, the National Energy Board, and Alberta Transportation apply to the work of this section with regard to highway, railway and pipeline crossings.

1.3 SUBMITTALS

.1 Submit in writing to Owner's Representative, complete details regarding auger boring method proposed, and do not commence work until after the Owner's Representative has advised in writing that the work may proceed.

2 Products

2.1 CASING PIPE

.1 Casing pipe diameter will be governed by the carrier pipe size, minimum clearance to adjacent utilities or structures, the size of the pipe insulators and by the type of carrier pipe joint, so that the carrier pipe can be installed without damage and the annular space between the casing and carrier pipes can be adequately backfilled. The Contractor may propose alternate casing pipe diameters to suit the proposed installation methods, for approval by the Engineer.

.2 Casing pipe lengths will be governed by the Contractor's construction methods and equipment, and as indicated on the drawings.

.3 The casing shall be steel pipe. Minimum casing wall thickness as indicated on the drawings, and to be selected by the Contractor such that no deformation occurs during installation, and that the casing provides a true alignment both vertically and horizontally.

2.2 CONCRETE

.1 In accordance with CSA-A23.1 – 25 MPa at 28 days.

.2 Cement: Type 50 sulphate resistant Portland cement.

2.3 GROUT

.1 Cement: Type 50 sulphate resistant Portland cement.

.2 Sand or crushed rock screenings to the following gradation:

Sieve Size	% Passing by Weight
9.50 mm	100%
4.75 mm	50 – 100%
2.00 mm	30 – 90%
0.425 mm	10 – 50%
0.075 mm	0 – 10%

2.4 PIPE INSULATORS AND SPACERS

.1 Two-part epoxy painted steel band with plastic runners as supplied by Plainsman Manufacturing Ltd. or approved equal.

3 Execution

3.1 EXCAVATION

.1 Excavate trenches, working shafts or pits as necessary to install the casing pipe, in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling.

.2 De-water the trench, as necessary.

3.2 CASING

.1 Install the pipe by auger boring. Monitor line and grade of the casing pipe with appropriate instruments. Monitor loss of ground, over-excavation or settlement of the structures, pipes, or surface above the crossing. Halt all operations, take immediate remedial action, and inform the Owner's Representative if loss of ground or over-excavation is detected.

.2 Install the casing pipe so that the carrier pipe can be laid to the line and grade as shown on the drawings, with tolerances as required for the carrier pipe as specified in related sections.

.3 Backfill any detectable voids around the outside of the casing pipe with sand or grout.

3.3 CARRIER PIPE

.1 Refer to related sections for the specification for carrier pipe.

.2 Attach plastic or other approved pipe insulators at predetermined intervals to ensure the pipe is correctly located in the casing pipe and to prevent flotation and sags. The use of wooden spacers will not be allowed.

.3 Fill the annular space between the carrier pipe and casing pipe with pneumatically blown sand or pressure grout, unless indicated otherwise on the drawing.

.4 Fill each end of the casing around the carrier pipe with a waterproof concrete plug, unless the casing is under railroad tracks, or otherwise shown on the drawings.

3.4 BACKFILLING

.1 Backfill trenches or pits in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling.

.2 Where working shafts, pits or trenches have been excavated below normal trench depth and wider than a normally excavated trench to accommodate boring, the Contractor shall provide an engineered design for the backfill of the subgrade. Unless otherwise approved by the Owner', the over-excavated depth shall be backfilled with fillcrete.

.3 If the excavation for working shafts, pits, or trenches is such that trench conditions assumed for the design of the pipe are affected by the Contractor's methods, the Contractor shall provide an engineered design for a higher class of bedding for the pipe or a stronger class of pipe, or both, on the affected side(s) of the cased section and install the pipe and bedding at no extra cost to the Owner, and as directed by the Owner's Representative.

.4 Do not backfill pits until the Owner's Representative has inspected the installation.

4 Measurement and Payment

.1 Augured Crossings

.1 Supply and Install Watermains by Augured Crossing will be measured and paid for per lineal metre of carrier pipe installed. Unit rate will include casing pipe, casing insulators and spacers, pipe, fittings, flange isolation kits, transition connections, coupling and field closures, thrust restraint, cathodic protection, excavation, compaction, and backfilling auger and receiving pits, including fillcrete backfill, replacement and restoration of existing utilities, pressure test, chlorination, flushing, water control and disposal. Unit rate to also include all labour equipment and materials incidental to the work.

.2 Supply and Install Sewer Mains by Augured Crossing will be measured and paid for per lineal metre of carrier pipe installed. Unit rate will include supply and installation of auguring equipment, excavating, compacting, and backfilling of pits, including fillcrete backfill, supply and installation of pipe, CCTV inspection, quality control testing, water control and disposal, and bypass pumping as required. Unit rate to also include all labour, equipment, and materials incidental to the work.

END OF SECTION

1 General

This Section specifies requirements for direct burying of underground cable ducts under roadways and boulevards.

2 Products

2.1 PVC DUCTS AND FITTINGS

.1 PVC Duct and fittings, size as specified:

.1 Type DB2.

.2 6.1 m lengths.

.3 One end belled.

.4 Conforming to CSA C22.2, No. 211.1

.2 PVC Primer

.1 Approved for cleaning PVC DB-2 electrical duct surfaces in preparation of duct interface.

.3 PVC Cement

.1 Approved for solvent welding for PVC-DB2 components.

2.2 CONCRETE

.1 25 MPa concrete to Section 3 02 00 – Basic Concrete Materials and Test Method

2.3 BEDDING MATERIAL

.1 Clean sand to Section 3 04 00 – Aggregate Materials

3 Execution

3.1 PREPARATION

.1 Duct and fittings to be clean and dry before installation.

.2 Prior to installation, obtain Owner’s Representative approval of duct and fittings.

3.2 TRENCHING

.1 Do trenching work in accordance with Section 2 01 00 – Excavating, Trenching and Backfilling.

.2 Trench alignment and depth require approval from Owner's Representative prior to placing bedding material and duct.

.3 Trench width to be determined by the number of ducts placed horizontally in trench with 50 to 75 mm separation between ducts or width of compaction equipment, whichever is greater.

.4 Trench depth to be as follows (if depths other than those listed are required, obtain Owner's Representative approval):

.1 Road crossing 1.0 m below top of pavement elevation.

.2 Under concrete or paving stone sidewalks, 0.75 m.

.3 Landscaped areas, 0.9 m.

3.3 GRANULAR BEDDING

.1 Place clean sand bedding material to a minimum depth of 75 mm.

.2 Shape bed true to grade to provide a continuous uniform bearing surface for the duct.

.3 Compact bedding to 95% Standard Proctor Density.

3.4 INSTALLATION

.1 Lay and join duct in accordance with manufacturer's instructions.

.2 Lay duct on prepared bed true to line and grade, with duct invert smooth and free of sags or high points. Ensure duct is in contact with bed throughout its full length.

.3 Place parallel lengths of duct in a horizontal layer across bottom of trench with 50 mm spacing. Vertical stacking of duct will not be permitted.

.4 Pipe Jointing

.1 Prepare joints in accordance with manufacturer's recommendations by removing all sharp edges and burrs from inside the conduit.

.2 Clean all joints with approved pipe cleaner.

.3 Apply solvent cement in accordance with manufacturer's recommendations and complete joint. Do not disturb joint for 24 hours to allow for proper curing of joint solvent.

.4 Install end caps or plugs on the end of all ducts.

3.5 DUCT CROSSINGS

.1 When required to cross existing ducts, place sufficient bedding material to provide a minimum separation of 150 mm between the duct banks.

3.6 CONCRETE ENCASEMENT

.1 Place concrete encasement to a minimum thickness of 150 mm at all bends 45 degrees or greater.

3.7 DUCT TERMINATION

.1 For road crossing, end duct installation 2.0 m clear of paved road surface or back of curb, 1.0 m clear of sidewalk or as directed by Owner's Representative.

3.8 MARKER POSTS

.1 Install 50 x 100 mm board from invert to 1.0 m above ground at each end of the duct installation.

.2 Install 1200 mm x 15 mm diameter steel marker pin at end of duct. Set top of pin flush with existing surface after final backfill.

3.9 BACKFILL

.1 Upon completion of duct laying and after the Owner's Representative has inspected the duct joints, surround and cover ducts with minimum 75 mm clean sand bedding material compacted to 95% Standard Proctor Density.

.2 Place backfill material, above bedding material, in uniform layers not exceeding 150 mm compacted thickness up to grades indicated.

.3 Under paved areas and sidewalks, compact to 97% Standard Proctor Density. In other areas to 90% Standard Proctor Density.

.4 During backfilling and compacting ensure that ducts are not disturbed or damaged. Repairs to damaged duct at Contractor's expense.

4 Measurement and Payment

.1 Trench, excavation, and compaction, and backfill will be measured under Section 2 01 00 Excavating, Trenching and Backfilling.

.2 Supply and installation of duct will be measured in lineal metres of installed materials as measured in a horizontal line from the designated started to the end of installation.

.3 Supply and installation of connections from the main duct to streetlight base, secondary voltage service vault and other connections shown on the drawings shall be measured as the number installed.

.4 Supply and installation of connections to include all trenching, compaction and backfill from main duct trench to connection location and for the supply of all duct, bends, couplings, and concrete required to make the connection.

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Federal Legislation

.1 Canadian Environmental Protection Act (CEPA), 1988.

.2 Canadian Environmental Assessment Act (CEAA), 1995.

.3 Transportation of Dangerous Goods Act (TDGA), 1992.

.4 Motor Vehicle Safety Act (MVSA), 1995.

1.2 STORAGE AND PROTECTION

.1 Protect existing features in accordance with Section 2 01 00 - Excavating, Trenching and Backfilling.

.2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Owner's Representative and at no cost to the Owner.

.3 Existing underground utilities: Establish the location of all underground utilities and have their location adequately marked. Notify the Owner's Representative before disturbing the utility lines.

.4 Prevent movement, settlement or damage of adjacent surfaces and structures. Provide bracing and shoring as required. Make good drainage and be liable for injury caused by demolition.

.5 In all circumstances ensure that demolition work does not adversely affect adjacent watercourses, groundwater, and wildlife, or contribute to excess air and noise pollution.

.6 Do not dispose of waste of volatile materials such as, mineral spirits, oil, petroleum-based lubricants, toxic cleaning solutions, PCB's, asbestos products, or Freon (Chlorinated hydrocarbons) into watercourses, storm, or sanitary sewers. Ensure proper disposal procedures are maintained throughout the project. Wastes shall be disposed of at an approved facility.

.7 Do not pump water containing suspended materials into watercourses, storm, or sanitary sewers or onto adjacent properties.

.8 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.

.9 Protect trees, plants and foliage on site and adjacent properties where indicated.

1.3 EXISTING CONDITIONS

.1 Prior to the start of any demolition work remove contaminated or hazardous materials from site and dispose of in a safe manner in accordance with Transportation of Dangerous Goods Act (TDGA) and all other applicable regulatory requirements. Contractor shall dispose of materials at an approved location/facility.

1.4 REGULATORY REQUIREMENTS

.1 Ensure all work is performed in compliance with all applicable Federal and Provincial regulations.

1.5 SUBMITTALS

.1 Prior to commencement of work on site, submit a waste removal plan with details indicating waste containment on site, identify materials for reuse, recycling and landfill, schedule of selective demolition, material description, nature of materials and quantities of materials to be salvaged, analytical results for soils, anticipated frequency of tippage, and name of all haulers, planned haul route, type of vehicles to be used, arrangements for hazardous waste disposal and confirmation in writing providing proof of proper disposal following any waste haulage approved waste collection facility.

.2 A demolition fire safety plan in conformance with 5.6 of the Alberta Fire Code is required to be submitted (to the fire prevention branch) for review and acceptance prior to the commencement of any demolition activity related to the project.

1.6 SCHEDULING

.1 Ensure project timelines are met without compromising specified minimum rates of material diversion. Notify the Owner’s Representative in writing of delays.

2 Products

.1 Not applicable.

3 Execution

3.1 PREPARATION

.1 Inspect site with the Owner’s Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.3 Notify and obtain approval of utility companies before starting demolition.

3.2 SEQUENCES OF OPERATION

.1 Removal

.1 Remove items as indicated.

.2 Do not disturb items designated to remain in place.

.3 In removal of pavements, curbs, and gutters:

.1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by the Owner's Representative.

.2 Protect adjacent joints and load transfer devices.

.3 Protect underlying and adjacent granular materials.

.4 When removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving, prevent contamination with base course aggregates.

.5 All pipes and manholes are to be removed. Undertake abandonment of pipes and manholes upon approval of the Owner's Representative only.

.6 When removing pipes under existing or future pavement area, excavate at least 150 mm below pipe invert.

.7 Stockpile topsoil for final grading and landscaping. Provide erosion control and seeding if not immediately used.

.2 Removal from Site

.1 Interim removal of stockpiled material will be required if it is deemed to interfere with operations or other contractors.

.2 All waste must be hauled to an authorized disposal site listed in waste reduction work plan / waste management plan. Deviation from waste reduction work plan must be approved in writing by the Owner's Representative.

.3 Salvage

.1 Carefully dismantle items containing materials for salvage and stockpile salvaged materials.

.4 Sealing

.1 Seal pipe ends and walls of manholes or catch basins as indicated. Securely plug to form watertight seal.

.5 Disposal of Material

.1 Dispose of materials not designated for salvage or reuse to an approved disposal site.

.6 Backfill

.1 Backfill in areas as directed by the Owner's Representative.

3.3 RESTORATION

.1 Restore areas and existing works outside areas of demolition to conditions that existed prior to commencement of work.

.2 Use only soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.4 CLEANUP

.1 Upon completion of Work, and immediately prior to inspection, surplus materials, tools, construction machinery and equipment not required for performance of remaining Work, and thoroughly clean all surfaces and components. Leave site free of all foreign and surplus materials, cleaning equipment, obstructions, hindrances.

.2 Use only cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

4 Measurement and Payment

.1 Concrete Removal

.1 The following removals will be measured and paid for per square metre (m^2) removed:

.1 Concrete walkway.

.2 Concrete curb ramp.

.3 Concrete crossing.

.4 Concrete slab-on grade.

.2 The following removals will be measured and paid for per lineal metre removed:

.1 Concrete curb and gutter.

.2 Concrete curb.

.3 Concrete gutter up to 500 mm wide; and

.4 Concrete gutter greater than 500 mm wide.

.3 Miscellaneous concrete will be measured and paid for per cubic metre removed.

.4 Unit price to include sawcut limits of removal where required; break and excavate; separate materials and/or remove unacceptable reinforcement; load, haul, and stockpile salvageable materials at designated locations; haul and dispose of surplus materials including dumping fees if any; dust control; maintain and cleanup haul routes.

.2 Remove and dispose hydrants will be measured and paid for per hydrant removed and disposed. The price shall include all work incidental to the removal and disposal of the hydrant including saw-cutting, removal and disposal of hydrant including hydrant, hydrant lead, valve, hydrant tee and all fittings. Until price to also include all labour, equipment and materials incidental to the work.

.3 Remove and dispose of valves will be measured and paid for per valve removed and disposed. The price shall include all work incidental to the removal and disposal of the valve including saw-cutting, removal and disposal of valve, and all labour, equipment and materials incidental to the work.

.4 Remove and dispose of watermains and fittings will be measured and paid for per metre along the centerline of pipe removed. The price shall include saw-cutting, removal and disposal of watermain and all fittings, and all other labour, equipment and materials incidental to the work.

.5 Remove and dispose of water services will be measured and paid for per metre along the centerline of service removed. The price shall include saw-cutting, removal and disposal of water service pipe, curb cock, and fittings, and all other labour, equipment and materials incidental to the work.

.6 Remove and dispose of sanitary sewer mains will be measured and paid for per metre along the centerline of pipe removed. The price shall include saw-cutting, removal and disposal of sanitary sewer main and all fittings, and all other labour, equipment and materials incidental to the work.

.7 Remove and dispose of sanitary sewer services will be measured and paid for per metre along the centerline of pipe removed. The price shall include saw-cutting, removal and disposal of sanitary sewer service and all fittings, and all other labour, equipment and materials incidental to the work.

.8 Remove and dispose storm sewer pipe will be measured and paid for per metre along the centerline of pipe removed. The price shall include saw-cutting, removal and disposal of storm sewer pipe, and all other labour, equipment and materials incidental to the work.

.9 Manhole and catch basin removal.

.1 Removal and disposal of the following will be measured and paid for per unit removed and disposed:

.1 Manholes

.2 Catch Basin manholes

.3 Catch Basins

.2 Price to include all work incidental to remove and dispose of existing, disposal of surplus material and general clean-up. Price to also include all other labour, equipment and material incidental to the work.

.10 Remove and dispose of existing signs will be measured and paid for per sign removed. Unit price shall include all labour, equipment and materials required to remove and dispose existing signs.

END OF SECTION

1 General

1.1 REFERENCES

.1 Not used

1.2 SUBMITTALS

.1 Submit traffic accommodation strategy to detailing plan for rerouting traffic during milling operations 2 weeks in advance.

1.3 PROTECTION

.1 Protect existing pavement not designated for removal, light units, and structures from damage. In event of damage, immediately replace or make repairs to approval of Owner's representative at no additional cost.

2 Products

2.1 MATERIALS

.1 Cold milled asphalt pavement which is to be recycled in hot mix asphalt concrete under this contract may be stockpiled at designated asphalt plant site.

.2 All other cold milled asphalt pavement which is to be retained by the Owner to be stockpiled at designated site as indicated by Owner.

3 Execution

3.1 PREPARATION

.1 Prior to commencing removal operation, inspect and verify with Owner's Representative, areas, depths, and lines of asphalt pavement to be removed.

.2 Sweep the pavement surface with a mechanical sweeper to remove debris and dirt accumulations prior to cold milling.

3.2 TRAFFIC SAFETY

.1 Provide signed advance warning of cold milled areas opened to traffic before paving, as follows:

'Bump' – all transverse milled edges and edges at exposed utility structures.

'Uneven Pavement' – all longitudinal milled edges, and edges within pedestrian crosswalk Areas

.2 Ramp vertical edges created by milling to a minimum 10:1 slope. Material used in the ramping must be approved by the Owner's Representative and must be maintained until removal prior to paving.

3.3 EQUIPMENT

.1 Use cold milling, planing or grinding equipment with automatic grade controls capable of operating from a stringline, and capable of removing part of pavement surface to depths or grades indicated.

.2 Use excavating equipment capable of separating, removing, and loading asphalt for removal offsite. Refrain from striking ground adjacent to existing building and structures for breakout. Use appropriate saw cutting and breakout equipment.

3.4 REMOVAL

.1 Excavation

.1 Remove existing asphalt pavement to lines and grades indicated or established by Owner's representative in field.

.2 Use equipment and methods of removal and hauling which do not damage or disturb adjacent and underlying pavement.

.3 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel, or other materials.

.4 Provide for suppression of dust generated by removal process.

.2 Cold Milling

.1 Mill to depth and/or grade line as indicated.

.2 Mill pavement to expose vertical surface of gutter face, manhole frames, water valves, survey monuments, power, telephone, or water vaults, or any other structures within milling area for the full required depth of milling.

3.5 QUALITY ASSURANCE

.1 Not used.

4 Measurement and Payment

.1 Removal of existing asphalt pavement will be measured in square metres (m^2) of surface removed for the depths indicated on the Bid Form.

.2 Cold milling for the depths indicated on the bid form shall be measured and paid for by the square meter (m^2) of actual area milled. Price to include all labour, equipment, materials, incidentals and clean up to complete this work.

.3 Payment under this item will include operations involved in removing, hauling and stockpiling or disposal of designated pavement and cleaning of remaining pavement surface.

END OF SECTION

1 General

1.1 Not Used

2 Products

2.1 MATERIALS

.1 Approved abrasives and solvents used for removal of paint, oil, grease, rubber deposits: proprietary products specially designed for pavement cleaning.

3 Execution

3.1 REMOVING PAVEMENT MARKINGS

.1 Remove rubber tire deposits and paint markings, as indicated by sand or water blasting, rotary grinding, heater planing or other method approved by Owner's representative.

.2 Exercise care to avoid dislodging of coarse aggregate particles, excessive removal of fines, damage to bituminous binder or damage to joint and crack sealers.

.3 Do not heat pavement surfaces above 120^{o}C, when using heater planning equipment.

3.2 PAVEMENT SURFACE CLEANING

.1 Remove sealing compound which has protruded excessively, where directed by Owner's representative. Dispose of removed material.

.2 Remove dust, contaminants, loose and foreign materials, oil, and grease, in areas designated and by method approved by Owner's Representative.

.3 Use mechanical rotary power brooms supplemented by hand brooming.

3.3 QUALITY ASSURANCE

.1 Not used.

4 Measurement and Payment

.1 No separate payment will be made for cleaning pavement surfaces.

.2 Measurement for removal of pavement markings shall be made by the meter for the following paint line types:

.1 Dashed lines, solid lines (all types),

.3 Measurement for removal of pavement markings shall be made by the unit for the following paint line types:

.1 Stop Bars, zebra bars, arrows (single and double), and symbols.

.4 No extra payment will be made for varying widths.

.5 No extra payment will be made for double arrows.

.6 Price to include all labour, equipment, materials, clean-up, incidentals required to complete the work.

END OF SECTION

1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.

.4 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

.5 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

.6 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

.7 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

.8 ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 CSA International

.1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Te6st and Standard Practices for Concrete.

.2 CSA A283, Qualification Code for Concrete Testing Laboratories.

.3 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.2 ABBREVIATIONS AND ACRONYMS

.1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.

.1 Type GU, GUb and GUL - General use cement.

.2 Type MS and MSb - Moderate sulphate-resistant cement.

.3 Type MH, MHb and MHL - Moderate heat of hydration cement.

.4 Type HE, HEb and HEL - High early-strength cement.

.5 Type LH, LHb and LHL - Low heat of hydration cement.

.6 Type HS and HSb - High sulphate-resistant cement.

.2 Fly ash:

.1 Type F - with CaO content less than 15%.

.2 Type CI - with CaO content ranging from 15 to 20%.

.3 Type CH - with CaO greater than 20%.

.3 GGBFS - Ground, granulated blast-furnace slag.

1.3 SUBMITTALS

.1 Provide certification that the plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1.

.2 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA-A23.1 and that mix design is adjusted to prevent alkali aggregate reactivity problems.

.3 Submit mix designs and aggregate tests prior to starting concrete work.

.4 Submit proposed quality control procedures. Identify procedures that will prevent non-compliant concrete from entering the final work.

.5 Submit drawings showing proposed construction joint locations and pour sequence for review prior to starting concrete work.

.6 Submit concrete test results taken during concrete pour. Material samples shall be taken directly from truck chute.

2 Products

2.1 MATERIALS

.1 Portland cement: to CAN/CSA A3001.

.2 Supplementary cementing materials: to CAN/CSA A3001.

.3 Water: to CSA-A23.1.

.4 Aggregates: to CSA-A23.1.

.5 Air entraining admixture: to ASTM C260.

.6 Chemical admixtures: to ASTM C494/494M or C1017. Owner's Representative is to approve accelerating or set retarding admixtures during cold and hot weather placing.

.7 Use of calcium chloride or admixtures containing calcium chloride is not permitted.

.8 Pressure Injected Epoxy Grout: to be reviewed by Owner's Representative.

.9 Floor Hardener: non-metallic, premixed, abrasion resistance hardener. Acceptable product: Mastercron by BASF.

2.2 CONCRETE MIXES

.1 Proportion normal density concrete in accordance with CSA-A23.1 Alternative 1 (Performance), to give following properties:

Designation	**S1**	**S3**
Application	Foundations Walls/Slabs	Mud Slabs
Structural Requirements		
CSA Exposure Class	F-1	N
Minimum Specified Strength (MPa)	35	10
Age (days) for Specified Strength	56	28
Maximum W/CM Ratio	0.45	
Maximum Aggregate Size	20	20
Durability Requirements		
Exposure to Sulphate Attack	N	N
Alkali Aggregate Reactivity Addressed (Y/N)	Y	Y
Aggressive Chemical/Waste/Other	N	N
Air Content Category	1	2
Other		
Architectural Requirements		
Color (Y/N)	N	N
Materials		
SCM Usage (Y/N)	Y	Y
HVSCM 1 or HVSCM 2	2	
Fly Ash (Y/N)	Y	

Designation	**S1**	**S3**
Application	Foundations Walls/Slabs	Mud Slabs
Fly Ash Class	F or Cl	
Silica Fume (Y/N)	N	N
Ground Granulated Blast Furnace Slag (GGBFS) (Y/N)	N	N

.2 Volume stability to be considered in mix proportions to prevent creep and shrinkage in accordance with Cl.4.1.1.9 and Cl.4.3.6.

.3 Do not change concrete mix without prior approval of Owner's Representative. Should change in materials source be proposed, the new mix design is to be approved by Owner's Representative.

.4 Mix design to minimize shrinkage and to maximize watertightness.

.5 Mortar Rich Mix for base of walls: Use same mix proportions as item .1 except omit coarse aggregate.

.6 Mix design shall bear the signature and stamp of qualified professional engineer registered in the province of Alberta.

3 Execution

3.1 GENERAL

.1 Do cast-in-place concrete work in accordance with CSA-A23.1.

.2 Minimum 3 days to elapse between adjacent walls or slab pours.

.3 All phases of construction, materials, and workmanship are to proceed with full regard to providing a watertight structure upon completion.

.4 Temperature of the concrete during discharge into the forms is to be between 10ºC and 22ºC. The temperature of the mix is to be maintained below 22ºC maximum temperature. Typical methods of reducing mix temperature include evaporative cooling of aggregate stockpiles, use chilled batch water or the inclusion of ice to the mix at the plant, taking care to maintain the design water/cementing material ratio. Obtain approval of Owner's Representative for proposed method of temperature control.

3.2 WORKMANSHIP

.1 Obtain Owner’s Representative's approval before placing concrete. Provide 48 hours notices prior to placing of concrete.

.2 Pumping of concrete is permitted.

.3 Delivery Time – Concrete shall be delivered to the site and discharged into the work within two (2) hours after introduction of the mixing water to the cement and aggregate.

.4 Ensure reinforcement and inserts are not disturbed during concrete placement.

.5 Prior to placing of concrete obtain Owner’s Representative's approval of proposed method for protection of concrete during placing and curing.

.6 Do not place concrete against any surfaces such as rebar, concrete or formwork that have a surface temperature of less than 5°C.

.7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.8 Consolidate concrete using internal vibrators. Use pencil vibrators where larger sizes are unsuitable.

.9 Do not place load upon new concrete until specified cure times have been met.

3.3 INSERTS

.1 Set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated on structural or civil drawings must be approved by Owner’s Representative.

.2 No sleeves, ducts, pipes, or other openings shall pass through beams, except where expressly detailed on structural or civil drawings or approved by Owner’s Representative.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Owner’s Representative before placing of concrete.

.4 Check locations and sizes of sleeves and openings shown on structural and civil drawings with architectural, mechanical, and electrical drawings.

.5 Anchor bolts

.1 Place anchor bolts to templates under supervision of trade supplying anchors prior to placing concrete.

.2 With Owner's Representative's approval, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be at least 100 mm in diameter. Drilled holes to be minimum 25 mm larger in diameter than bolts used.

.3 Protect anchor bolt holes from water accumulations.

.4 Set bolts and fill holes with shrinkage compensating grout.

3.4 CONSTRUCTION JOINTS

.1 Provide construction joints as shown on drawings. Submit pour sequence for review by Owner's Representative as specified in Section 3 02 00 - Concrete Formwork

.2 Surfaces shall be clean, free of all laitance, unsound concrete and roughened to CSP8 (scabbled) ICRI surface prep guide; sandblast, green cut or hydro blast as required.

.3 Install PVC waterstop or expanding waterstop in all wall and floor joints as shown. Waterstop to be fully continuous. Reinforcement continuous through the joint.

.4 All horizontal wall construction joints to have a mortar rich mix achieved by the removal of all coarse aggregate. Place mix 150 mm deep as shown and in accordance with CSA A23.1. Surface of vertical and horizontal joints to be saturated, surface dry with no standing water and prepared in accordance with ICRI, Surface Preparation Guide.

.5 A minimum of three (3) days is to elapse between adjacent slab and wall concrete placement.

.6 Omit floor hardener in areas required for equipment bases and roughen to achieve desired bond.

3.5 FINISHING

.1 Finish concrete in accordance with CSA A23.1 and as shown on drawings. Concrete tolerance - use straight edge method, class A except that exposed floor slabs, stairs and landings shall be Class B.

.2 Protect slab surfaces from excessive drying before and during finishing operations. The use of fly ash concrete will tend to increase the setting time of a concrete mix while reducing the amount of bleed water available to balance evaporation. Rapid loss of moisture from the surface of the concrete can result in defects such as plastic shrinkage cracking, crazing and/or crusting.

.3 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

.4 Exposed surfaces within the chamber shall be given a sack-rubbed finish.

.5 Exposed exterior work and chamber interior wall surfaces shall be given a smooth rubbed finish.

.6 Exposed roof slab shall be given a transverse broom finish.

.7 Base slabs and sumps shall be given a trowel finish.

.8 Apply floor hardener at rate of 8 kg/m^2 to areas shown on drawings (or in accordance with manufacturer’s instructions).

.9 All tie recesses are to be grouted with waterproof grout.

.10 Roughen top of equipment bases to provide bond for grout.

3.6 CRACK REPAIR

.1 Utilize the best possible care and construction techniques to minimize cracking of concrete walls and slabs.

.2 Cracks which do appear shall be routed out on each face and repaired with Cementitious waterproof grout in accordance with manufacturer's recommendations, except that cracks which are more than 0.50 mm width or deemed by the Owner’s Representative to be structurally detrimental, or subject to movement shall be grouted with pressure injected epoxy resin.

.3 Obtain approval from Owner’s Representative of pressure grouting techniques and epoxy materials to be utilized prior to proceeding with the Work.

.4 Depth of epoxy grouting shall be sufficient to restore structural integrity and/or watertightness, as required, but shall not be less than 100 mm.

.5 Cure crack repairs to manufacturer's instructions.

3.7 CURING

.1 In accordance with CSA A23.1 – Concrete Materials and Methods of Concrete Construction.

.2 Provide wet curing for not less than seven (7) consecutive days in all cases, at not less than 10°C. In addition, suspended slabs shall be continuously cured until the concrete has attained a minimum of 80% of the specified strength.

.3 Acceptable curing methods:

.1 Absorptive mat or fabric kept continuously wet.

.2 Other moisture retaining method approved by the Owner's Representative.

.4 Provide insulation, hoarding and/or heating as required to prevent freezing during inclement weather.

.5 During hot weather, begin curing process immediately after finishing.

3.8 COLD WEATHER AND HOT WEATHER CONCRETING

.1 Hot and cold weather placement, protection, and preparation to comply with CSA-A23.1.

.2 Temperature of concrete placed during hot weather not to exceed the limits specified in Paragraph 3.1.4.

.3 Also reference Section 03 02 30 Cast-In-Place Concrete

3.9 FIELD QUALITY CONTROL

.1 A qualified testing laboratory approved by Owner's Representative in accordance with CSA A23.1 will carry out inspection and testing of concrete and concrete materials for quality control. All costs to be borne on Contractor. Copies of the test results shall be sent directly to the Contractor and Owner's Representative.

.2 Take concrete samples for testing in accordance with CSA A23.2. One (1) strength test shall consist of test cylinders for each 50 m^3 of concrete, or portions of each mix type of concrete or each separate type of structural element in any one (1)-day's pour. For concrete with specified fifty-six (56) day strength, strength test shall consist of minimum four (4) test cylinders. Test first cylinder at seven (7) days one (1) at twenty-eight (28) days and remaining two (2) at 56 days. For concrete with specified twenty-eight (28) day strength, strength test shall consist of minimum three (3) test cylinders. Test first cylinder at seven (7) days and remaining two (2) at twenty-eight (28) days.

.3 Owner's Representative will request additional test cylinders during cold weather concreting.

.1 After September 30th or if the ambient air temperature is below 0°C or is likely to fall below 0°C within 72 hours after placement, two additional cylinders shall be made for each test. These two cylinders will be field cured in a manner that simulates curing of the concrete placed.

.4 Cure cylinders on Site under same conditions as concrete that they represent.

.5 Compressive strength

.1 Test cylinders shall be in accordance with CSA Test Method A23.2-9C compressive strength of Cylindrical Concrete Specimens and shall be the average of the strengths of the test cylinders tested at the same age.

.2 The strength level of the concrete shall be considered satisfactory if the averages of all sets of three consecutive strength tests for the concrete are equal to or exceed the specified strength and no individual strength test is more than 5 MPa below the specified strength.

.6 Air Content

.1 Air content determinations shall be made in accordance with CSA Test Method A23.2-7C, Air Content of Plastic Concrete by the Volumetric Method.

.2 During construction start-up, every load or batch of concrete shall be tested until such time as satisfactory control of the air content has been established. Air content test taken with the test cylinders will be sufficient once satisfactory control has been established.

.3 Whenever a test falls outside the specified limits the testing frequency shall revert to one test per load or batch until such time as satisfactory control is re-established.

.7 Slump

.1 Slump tests made in accordance with CSA Test Method A23.2-5C.

.2 Slump of Concrete shall be made in conjunction with each strength test.

.8 Non-destructive Methods for Testing Concrete shall be in accordance with CSA A23.2 – Methods of Test for Concrete. Make good concrete surfaces after completion of tests.

.9 Inspection or testing by Owner's Representative will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

3.10 FAILURE TO MEET TEST REQUIREMENTS

.1 Strength

.1 If the concrete tested in accordance with these specifications fails to meet the strength requirements, the Owner's Representative shall have the right to require any one or all the following at no additional expense to the Owner.

.1 Change the concrete mix proportions for the remainder of the work.

.2 Core the portions of the work in question and test in accordance with CSA Test Method A23.2-14C, Obtaining and Testing Drilled Cores for Compressive Strength Testing.

.3 Replace the concrete, represented by the tests, with concrete which meets these specifications.

.2 Air Content

.1 If the measured air content falls outside the limits specified, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the load of concrete shall not be used for construction.

.2 Where deemed necessary, the Owner's Representative will test hardened concrete for air content and spacing factor by the linear traverse method, ASTM Designation C457, Modified Point- Count Method, Air-Paste Ratio Method of Calculation. Concrete tested by this method using a magnification of 60X and found to have a spacing factor greater than 0.2 mm will be rejected, and complete replacement of the work will be required.

.3 Linear traverse testing cost will be borne by the Contractor if the concrete is proven defective.

.3 Slump

.1 If the measured slump falls outside the limits specified, a check test shall be made immediately on another portion of the same batch. In the event of a second failure the Owner's Representative may refuse to permit the use of the batch.

4 Measurement and Payment

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

1.1 REFERENCES

.1 Conform to the latest edition of the following reference standards:

.1 Canadian Standards Association (CSA)

.1 CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

.2 CSA-O86.1, Engineering Design in Wood (Limit States Design).

.3 CSA S269.1, Falsework and Formwork.

.2 Occupational Health and Safety Act - General Safety Regulation.

1.2 SUBMITTALS

.1 Comply with CSA S269.1, for falsework drawings and for formwork.

.2 Indicate sequence and location of proposed construction joints. Locate construction joints as shown and maximum 11 m in any direction, in all slabs and walls unless noted otherwise.

.3 On shop drawings, indicate method and schedule of construction, rate of pour, materials, arrangement of joints, ties, shores, waterstops, and locations of temporary embedded parts.

.4 Sample of form tie proposed.

.5 Each shop drawing submitted to bear the stamp and signature of qualified professional engineer registered in the Province of Alberta where failure of the form would be hazardous.

2 Products

2.1 MATERIALS

.1 Formwork lumber: plywood and wood formwork materials to CSA-O86.1, and CSA S269.1.

.2 Falsework materials: to CSA S269.1.

.3 Form ties: removable ends or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia in concrete surface, and leaving no metal within 25 mm of concrete surface when forms have been removed. Use tapered plastic cones on faces of concrete to facilitate grouting and use purpose made waterstop flange at mid-length of tie.

.4 Form release agent: non-staining type, containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms. Agent to be compatible with subsequent surface finishes.

3 Execution

3.1 ERECTION

.1 Verify lines, levels and column centres before proceeding with formwork and ensure dimensions agree with drawings.

.2 Construct falsework in accordance with CSA S269.1.

.3 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1.

.4 Obtain Owner’s Representative permission before framing openings not indicated in concrete beams or columns.

.5 Align form joints and make watertight. Keep form joints to minimum.

.6 Use 20 mm chamfer strips on external corners of beams, joints and columns.

.7 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.8 Clean formwork in accordance with CSA-A23.1, before placing concrete.

.9 Leave formwork in place for following minimum periods of time after placing concrete and strip formwork only after concrete has hardened adequately and has attained sufficient strength to support safely all superimposed loads to which it may be subjected.

.1 7 days for water retaining walls.

.2 7 days for columns.

.3 14 days for beam soffits, slabs, decks and other structural members, or 10 days when replaced immediately with adequate shoring to standard specified for falsework.

.10 Re-use of formwork and falsework subject to requirements of CSA-A23.1.

4 Measurement and Payment

4.1 MATERIALS

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

1.1 REFERENCES

.1 Reinforcing Steel Institute of Canada (RSIC), Reinforcing Steel Manual of Standard Practice.

.2 SP-66, ACI Detailing Manual.

.3 Canadian Standards Association (CSA)

.1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A23.3, Design of Concrete Structures.

.3 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

.4 CSA G40.20/ G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.2 SOURCE QUALITY CONTROL

.1 Provide Owner's Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Upon request inform Owner's Representative of proposed source of material to be supplied.

1.3 SHOP DRAWINGS

.1 Indicate bar bending details, lists and quantities of reinforcement on Shop Drawings.

.2 On placing drawings, indicate sizes, spacing, locations and quantities of reinforcement and mechanical splices, with identifying code marks to permit correct placement without reference to structural Drawings. Indicate sizes, spacing and locations of chairs, spacers, and hangers. Prepare reinforcement Drawings in accordance with the Reinforcing Steel Institute of Canada's (RSIC) Reinforcing Steel Manual of Standard Practice.

.3 Detail lap lengths and bar development lengths to CSA A23.3. Provide Class B tension lap splices in accordance with Clause 12.15.1 and Table 12-1, "Other Cases", unless otherwise indicated.

1.4 SUBSTITUTES

.1 Substitute different size bars only if permitted in writing by Owner's Representative.

2 Products

2.1 MATERIALS

.1 Reinforcing steel: billet steel, grade 400R, deformed bars to CSA G30.18, unless indicated otherwise.

.2 Chairs, bolsters, bar supports, spacers: to CSA A23.1.

.3 Mechanical splices: subject to approval of Owner’s Representative.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA A23.1.

.2 Obtain Owner’s Representative's approval for locations of reinforcement splices other than those shown on placing Drawings.

.3 Co-ordinate splices and lap locations with location of pour breaks and construction joints.

.4 Upon approval of Owner’s Representative, weld reinforcement in accordance with CSA W186.

.5 Ship bundles of bar reinforcement clearly identified in accordance with bar bending details and lists.

3 Execution

3.1 FIELD BENDING

.1 Do not field bend reinforcement except where indicated or authorized by Owner’s Representative.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Ship bundles of bar reinforcement clearly identified in accordance with bar bending details and lists.

.2 Prior to closing wall forms and placing concrete, obtain Owner’s Representative's approval of reinforcing material and placement.

.3 Place reinforcing steel as indicated on reviewed placing Drawings and in accordance with CSA A23.1.

.4 Place, support, and space reinforcing in alignment to position indicated and as follows:

.1 Exposed concrete, including the underside of slabs and beams are considered as architectural concrete: Use non-staining supports and spacers.

.2 Slabs on grade, structural beams, and structural slabs: Support reinforcement on and secure to supports. For base slabs, use pre-soaked, pre-cast concrete blocks for bottom mat and bar chairs for top mat.

.3 Provide additional bars necessary to support dowels, stirrups, or straight bars.

.4 Supports are to be purpose made and maintain integrity and watertightness of concrete construction.

.5 Provide 10M “U” spacers at 3 m on-centre horizontally and 1.5 m on-centre vertically to hold wall reinforcing mats in position.

.6 Support slab-on-grade and structural slab reinforcing at 1000 mm maximum on-centre.

.5 Provide tiers and spacers for both wall and slab reinforcing to prevent movement or displacement during concrete pour and to maintain specified reinforcing cover as shown on the Drawings.

.6 Steel members used as support for cast-in-place piping or pipe sleeves shall not be welded to wall or slab reinforcing members.

.7 All reinforcing steel shall be cleaned to the satisfaction of the Owner’s Representative, and free of any rust, scale, mortar, paint, oil mud, ice, or other foreign substances, which will reduce bond, prior to placement of concrete.

4 Measurement and Payment

4.1 CONCRETE REINFORCEMENT

.1 No separate payment will be made for work specified in this Section.

.2 Payment for concrete reinforcement will be included in the unit price for concrete.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C109/C109M, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens).
.2 ASTM C260, Specification for Air-Entraining Admixtures for Concrete.
.3 ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
.4 ASTM C332, Specification for Lightweight Aggregates for Insulating Concrete.
.5 ASTM C494, Specification for Chemical Admixtures for Concrete.
.6 ASTM C827, Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
.7 ASTM C939, Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
.8 ASTM D1751, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
.9 ASTM D1752, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
.2 CAN3-A266.1, Air-Entraining Admixtures for Concrete.
.3 CAN3-A266.2, Chemical Admixtures for Concrete.
.4 CAN/CSA A3000, Cementitious Materials Compendium.

1.2 SUBMITTALS

.1 At least 4 weeks prior to commencing work, inform Owner’s representative of proposed source of aggregates and provide access for sampling.

.2 Submit certificates in accordance with Section 1 04 00 – Submittal Procedures.

.3 Minimum 4 weeks prior to starting concrete work submit to Owner’s Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:

.1 Portland cement.
.2 Blended hydraulic cement.
.3 Supplementary cementing materials.
.4 Grout.
.5 Admixtures.

.6 Aggregates.
.7 Water.
.8 Waterstops.
.9 Waterstop joints.
.10 Joint filler.

.4 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.

.5 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

.6 Submit mix design in accordance with Section 1 04 00 – Submittal Procedures and a minimum of 7 days prior to delivery of any concrete to site.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Use excess concrete for: additional paving, post footing anchorage, swale rip-rap reinforcing. footing bottom, storm structure covers, underground utility pipe kickers, storm pipe flared end section, toe wash protection.

.2 Use trigger operated spray nozzles for water hoses.

.3 Designate a cleaning area for tools to limit water use and runoff.

.4 Carefully coordinate the specified concrete work with weather conditions.

.5 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.

.6 Choose least harmful, appropriate cleaning method which will perform adequately.

2 Products

2.1 MATERIALS

.1 Portland cement: to CAN/CSA-A3000.

.2 Supplementary cementing materials: to CAN/CSA-A3000.

.3 Water: to CAN/CSA-A23.1.

.4 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.

.5 Air entraining admixture: to CAN3-A266.1.

.6 Chemical admixtures: to CAN3-A266.2. Owner's Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

.7 Shrinkage compensating grout: pre-mixed compound consisting of non-metallic aggregate, Portland Cement, water reducing and plasticizing agents.

.1 Compressible strength: 30 MPa in 28 days.

.8 Post-Tensioning ducts: to CAN/CSA-A23.1.

.9 Curing compound: to CAN/CSA-A23.1 Type-D with fugitive dye.

.10 Concrete reinforcement: to Section 3 02 20 – Concrete Reinforcement.

2.2 MIXES

.1 Except where indicated or specified otherwise provide concrete mix as follows.

.1 Cement: Type 50 Portland cement for all works.
.2 Minimum compressive strength at 28 days: 32 MPa.
.3 Minimum cement content: 315 kg/m^3 of concrete.
.4 Nominal size of coarse aggregate: 14 - 20 mm.
.5 Slump at time and point of discharge: 25 to 80 mm.
.6 Air content: 5 to 8 %.
.7 Maximum water cement ratio: 0.45.
.8 Exposure Classification: C-2.

.2 Do not change concrete mix without prior approval of Owner's Representative. Should change in material source be proposed, new mix design to be approved by Owner's representative.

.3 Concrete placed after September 30 shall attain the specified strength in 7 days.

.4 The strength level of 32 MPa shall be achieved if the averages of all sets of 3 consecutive tests equal or exceed the specified strength and no individual strength test is more than 5 MPa below specified strength.

3 Execution

3.1 PREPARATION

.1 Obtain Owner's Representative approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

.2 Pumping of concrete is permitted only after Owner's Representative approval of equipment and mix.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

.4 Prior to placing of concrete obtain Owner's Representative approval of proposed method for protection of concrete during placing and curing in adverse weather.

.5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.6 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack solidly with shrinkage compensating grout to anchor and hold dowels in position. Do not place load upon new concrete until authorized by Owner's Representative.

3.2 CONSTRUCTION

.1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.

.2 Finishing.

.1 Finish concrete in accordance with CAN/CSA-A23.1.
.2 Use procedures acceptable to Owner's Representative or those noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.
.3 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

.3 Joint fillers.

.1 Locate and form isolation joints as indicated. Install joint filler in accordance with ASTM D1751.

3.3 SITE TOLERANCE

.1 Concrete tolerance in accordance with CAN/CSA-A23.1 straight edge method.

3.4 FIELD QUALITY CONTROL

.1 As per Section 03 02 00 Basic Concrete Materials and Test Methods

3.5 FAILURE TO MEET REQUIREMENTS

.1 As per Section 03 02 00 Basic Concrete Materials and Test Methods

3.6 REPAIR

.1 Repair defective areas while concrete is still plastic, otherwise wait until carving is complete.

.2 Where directed by Owner's Representative, remove defective work, and replace with new concrete.

.3 Where directed by Owner's Representative, grind off high surface irregularities.

3.7 COLD WEATHER REQUIREMENTS

.1 Hot and cold weather placement, protection, and preparation to comply with CSA-A23.1

.2 Concrete placed between April 16th and September 30th shall attain the minimum allowable compressive strength in 28 days. For concrete placed between October 1st and April 15th, 85% of the minimum allowable compressive strength shall be attained in 7 days.

.3 After placement, the concrete surface temperatures are to remain at or above 10°C until the concrete has attained at least 85% of the minimum allowable compressive strength. High Early Strength may be required before September 30th based on forecast weather conditions.

.4 When air temperature is at or below 5°C or is likely to drop below 5°C with 24 hours of placing concrete, the temperature of the concrete immediately after being deposited in the forms is not to be less than 10°C nor more than 30°C.

.5 Concrete shall not be placed on subgrade if the ground temperature is less than 5°C.

.6 If hot water is used in mixing, the water and aggregates shall be mixed for ½ minute prior to adding to the cement.

.7 During cold weather (ambient air temperature at or below 5°C) hoard and/or heat the space around the fresh concrete to maintain the concrete surface temperature at 10°C for 3 days.

.8 If a temperature of 10°C cannot be maintained for 3 days after placing concrete, placing shall cease.

.9 For mass concrete, the minimum temperatures stated above may be reduced at the discretion to the Owner's Representative.

3.8 HOT WEATHER REQUIREMENTS

.1 Hot and cold weather placement, protection, and preparation to comply with CSA-A23.1

.2 Refer to Section 03 02 00 Basic Concrete Materials and Test Methods.

.3 When the atmospheric temperature is higher than 23°C, the concrete temperature at the time of placing shall not exceed 30°C.

.4 In the event this limit is exceeded, the concrete operations shall be suspended, and any concrete already placed will be removed.

3.9 QUALITY ASSURANCE

.1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Section 1 04 00 – Submittal Procedures for Owner's Representative's approval for following items:

.1 Falsework erection.
.2 Hot weather concrete.
.3 Cold weather concrete.
.4 Curing.
.5 Finishes.
.6 Formwork removal.
.7 Joints.

4 Measurement and Payment

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C117, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m^3).

.4 ASTM D6690, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.2 SUBMITTALS

.1 In accordance with Section 3 02 30 - Cast-In-Place Concrete and Section 1 04 00 – Submittal Procedures.

2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: to Section 3 02 00 – Basic Concrete Materials and Test Methods.

.2 Curing Compounds: shall be a liquid type conforming to CGSB Specification 90-GP-1a and shall contain a temporary colour indicator.

.3 Joint Sealing Compound:

.1 To be used in the joint between two separately poured concrete structures.

.2 Will be an elastic type of sealer conforming to ASTM D6690.

.4 Sealing Solutions: Fifty percent (50%) boiled linseed oil and 50% kerosene or another sealant approved by Owner’s Representative.

.5 Non-Staining Mineral Type Form Release Agent: Chemically active release agents containing compounds that react with free lime to provide water soluble soap.

3 Execution

3.1 GRADE PREPARATION

.1 When constructing embankments provide a minimum 0.5 m shoulder outside of neat lines of concrete.

.2 Place fill in 150 mm layers and compact to minimum 100% Standard Proctor Density ASTM D698

3.2 GRANULAR BASE

.1 Allow the Owner's Representative to review subgrade before placing granular base.

.2 Place granular base material to lines, widths, and depths as indicated on drawings.

.3 Compact granular base in maximum 150 mm layers to at least 98% of maximum density to ASTM D698.

3.3 CONSTRUCTION WITH FORMS

.1 Forms

.1 Forms may be either steel or wood but shall produce a true line without irregularities in the alignment. Flexible forms shall be used for all structures having a radius of less than 40 m. All forms shall be cleaned of hardened concrete or other foreign matter. Sufficient forms shall be placed and checked before concrete is poured to ensure true line and grade. The forms shall be well stayed and braced or otherwise held rigidly to the established line and grade. Any form which has lost its shape or has become dented and rough shall not be used.

.2 Use of Template

.1 After the forms have been set to the lines and grades indicated, a template, supplied by the Contractor, shall be used to check that there is the specified clearance from the top of the forms to the base. This inspection shall be carried out by the Contractor in the presence of the Owner's Representative's.

.3 Placing Concrete

.1 Concrete shall be placed only after the forms have been inspected and approved by the Owner's Representative's.

.2 Concrete shall be placed only on base which is sufficiently moist to prevent absorption of water from the freshly placed concrete. Where necessary the base shall be sprinkled with water to raise the moisture content to the desired level.

.3 All forms shall be thoroughly moistened or oiled. Chemicals shall not be used to remove ice or hardened concrete from the forms.

.4 Concrete shall be handled from the mixer to the place of use as rapidly as possible by methods which will prevent the separation or loss of the ingredients. Concrete shall be deposited in the forms as close as possible to its ultimate location to reduce rehandling or flowing. Under no circumstances shall concrete that has partially hardened be used. Once a pour has started it shall be carried on as a continuous operation until the section is completed.

.5 A mechanical vibrator shall be used during the concrete placing operations as required to eliminate air pockets and honeycombing. To secure uniform dense surfaces, vibration shall be supplemented by hand spading.

.6 Concrete shall not be poured in the rain and freshly poured concrete surfaces shall be protected from rain, frost, dust and other physical damage, until it has obtained sufficient strength to resist marking.

.7 All pours shall start and stop at a contraction joint and surplus material shall be wasted.

.4 Stripping Forms

.1 The face of curb form shall be removed within 2 hours after the initial set to permit proper finishing of the concrete. Adequate care shall be taken to avoid damage to the concrete surface when removing the forms. Any patching that is necessary shall be done immediately after the forms have been removed.

3.4 SLIP FORMING

.1 Use only self-powered extruders with automatic line and grade control capable of placing, consolidating, screeding and float finishing in one pass.

.2 Operate concrete extruder continuously until section or scheduled pour completed. Empty hopper of concrete and construct joint containing two 1.2 m 10M deformed steel bars when operations delayed more than 30 minutes.

.3 Stringline to be inspected by Owner’s Representative’s prior to commencing operations. Adjust stringline as directed by Owner’s Representative’s. All stringline to be extended 15 m beyond limit of section to be poured.

.4 Vibrate concrete to obtain a dense, smooth finished mass.

.5 Finishing handwork to be minimized. Concrete requiring excessive hand finishing will be rejected.

.6 Construct joint containing two 1.2 m 10M deformed steel bars at the end of each section of extruded concrete.

.7 Areas of concrete to be formed and placed by hand to be completed within seven (7) days of completion of adjacent extruded section.

.8 Hand forming shall be used for curves where extruding cannot provide a smooth arc of the specified radius.

.9 Granular base not required for slip formed concrete except in areas of over excavation.

3.5 CONCRETE

.1 Obtain Owner's Representative's approval of granular base and reinforcing steel prior to placing concrete.

.2 Do concrete work in accordance with Section 3 02 30 - Cast-in-Place Concrete and as specified herein.

.3 Finish exposed surfaces to a smooth, uniform finish, free of open texturing and exposed aggregate. Do not work more mortar to surface than required. Do not use neat cement as a drier to facilitate finishing.

.4 Broom finish surface to provide non-skid texture.

.5 Round edges, including edges of joints, with 5 mm radius edging tool.

.6 Finish surfaces to within 6 mm in 3 m from line, level or grade as measured with a straight edge placed on surface.

.7 Cure concrete to CAN3-A23.1 Section 21.1.

.8 The curing compound must be applied uniformly in one application by means of an approved pressure distribution at an average of 0.2 litres per square metre.

3.6 EXPANSION AND CONTRACTION JOINTS

.1 Install contraction joints at least 1/4 of the depth of slab deep and 6 mm wide at intervals of 1.5 m.

.2 For curb and gutter, install contraction joints at least 40 mm deep and 6 mm wide at intervals of 3.0 m.

.3 When sidewalk is adjacent to curb, make joints coincide.

.4 Install isolation joints in concrete around manholes, catch basins, poles, hydrants, etc. and along length of concrete adjacent to existing sidewalks, catch basins, building or permanent structure.

.5 Construct longitudinal construction joints using 10M deformed tie-bars at 1 m spacing and extend at least 300 mm into both sides of the joint.

.6 Vary transverse construction joint spacing near the end of a pour as follows:

.1 If the end of the pour falls within 300 mm of a required joint location, the spacing of the last two joints shall be averaged.

.2 If the end of pour falls within 800 mm of a required joint location, average the spacing of the last three joints.

.7 Construct transverse construction joints using 10M deformed tie-bars at 300 mm spacing and extending at least 300 mm into both sides of the joint.

3.7 DIMENSIONS OF CONCRETE STRUCTURES

.1 Concrete structure dimensions are as shown on drawings.

3.8 REINFORCING STEEL

.1 Reinforcing steel shall be incorporated into the work as shown on drawings.

3.9 FINISHING

.1 Concrete Structures

.1 The top of the concrete shall be trowelled to a smooth finish. Excessive trowelling shall be avoided. The final finish shall be a transverse brushing with a soft bristle brush approved by the Owner's Representative's. The edges shall be neatly rounded. A mortar coat or excessive water shall not be used in the finishing process.

3.10 FINISH TOLERANCE

.1 Concrete placement procedures and equipment shall be carefully regulated to maintain the finished work within the following tolerances:

.1 The finished surface of concrete shall be within a tolerance of +10 mm with respect to the designated vertical alignment.

.2 The maximum allowable irregularity in the finished surface of concrete shall be 5 mm measured from a 3 m straight edge.

.3 Edges of sidewalks shall be within a tolerance of +15 mm with respect to the designated horizontal alignment.

.4 The maximum ponding depth shall be 5 mm.

.5 The maximum length of ponding shall be 2 m for each occurrence.

3.11 MARKINGS

.1 Contractor and Year of Construction

.1 The Contractor shall mark the concrete structure with a marking tool showing the initials of the Contractor and the year of construction. These marks shall be made at the ends of each block and at the termination points if the construction is terminated within the middle of a block.

.2 The letters and numerals of the marking tools shall be approximately 40 mm high.

3.12 CURING

.1 The surface of the concrete shall be protected from the sun and air by an approved membrane curing material. This protection shall be accomplished by coating the entire exposed surface of the concrete with a liquid compound immediately after the concrete has received its finish treatment. At the time the front and the back forms are removed the exposed concrete surfaces shall be coated with the membrane material.

.2 The membrane material shall be applied uniformly at the manufacturers recommended rate of application by means of an approved pressure spray distributor.

.3 The membrane material shall be so applied that the concrete surface is completely coated and sealed in one application.

.4 Under no circumstances shall any material be added to the curing compound as delivered by the manufacturer.

3.13 BACKFILL

.1 Allow concrete to cure for seven (7) days prior to backfilling.

.2 The Contractor shall backfill behind the concrete structure to the design cross section with borrow material, compacted to 95% of Standard Proctor Density ASTM D698.

.3 The backfill shall be placed as shown on the drawings or designated by the Owner's Representative.

.4 Placing of the backfill shall be done promptly after the forms have been stripped to avoid any possible damage to the concrete structure.

.5 The Contractor shall leave all cut or fill slopes in a trimmed, neat condition as designated by Owner's Representative or as shown on the drawings.

3.14 COLD WEATHER REQUIREMENTS

.1 When the atmosphere has a temperature lower than 5°C, all reinforcing materials, forms, and ground with which the concrete is to come in contact, shall be defrosted by means of live steam or by other approved methods.

.2 Canvas and other protective coverings used to conserve heat shall be kept clear of the concrete to permit free circulation of air.

.3 Straw or similar materials for protection against frost shall not be allowed to come in contact with fresh concrete.

.4 Refer to 03 02 30 Cast-In-Place Concrete

3.15 FROZEN CONCRETE

.1 All concrete showing evidence of freezing shall be removed from the job and replaced at the Contractor's expense.

3.16 HOT WEATHER REQUIREMENTS

.1 Concrete shall be protected from excessive loss of moisture during periods of hot and/or windy weather. Placing operations shall be discontinued if shallow cracking due to excessive drying is evident.

.2 Refer to Section 03 02 30 Cast-In-Place Concrete

3.17 JOINT SEALING

.1 A cut or preformed joint, 25 mm in depth and a maximum of 12 mm wide, shall be provided at the top of all separately poured, abutting concrete structures. A hot poured elastic type of sealer shall be placed in this joint, in accordance with the manufacturer's recommendations.

3.18 MAINTENANCE STANDARDS

.1 Concrete shall be replaced if one or more of the following exist:

.1 Any identified tripping hazards.

.2 Any crack greater than 2 mm in width.

.3 Three or more cracks in a single panel

.4 Longitudinal cracks in a single panel.

.5 Sidewalk panels with surface spalling greater than 10% of the panel area.

.6 Walk with less than 10 mm per metre of cross fall.

.7 Walk with greater than 40 mm per metre of cross fall.

.8 Gutter with less than 40 mm per metre of cross fall.

.9 Gutter with greater than 200 mm per metre of cross fall.

.10 Para ramps with greater than 80 mm per metre of cross fall.

.11 Vertical displacement greater than 6 mm.

.12 Joint separation greater than 12 mm.

.13 Valves above the concrete surface or more than 6 mm below.

.14 Settlements in gutter causing retention of water greater than 15 mm in depth.

.15 Concrete considered by the Owner's Representative to be deficient in appearance.

3.19 QUALITY ASSURANCE

.1 Refer to Section 302 30 – Cast In Place Concrete

4 Measurement and Payment

.1 The following concrete structures will be paid in by the meter as indicated:

.1 Curb and Gutter (measured along the face of curb)

.2 Monolithic sidewalk (measured along the face of curb)

.3 Monolithic residential driveway (measured along the face of curb inclusive of drop curbs for straight face curb)

.4 Concrete swales (measured along the centerline)

.5 Separate Sidewalk (measured along the centerline)

.2 The following concrete structures will be measured and paid for by the square meter (m^2) of area as indicated:

.1 Residential Driveways for separate sidewalk (measured by the finished surface area)

.2 Private Concrete walkway (measured by the finished surface area)

.3 Commercial Lane Crossings (measured by the finished surface area)

.4 Concrete median slabs (measured by the finished surface area)

.5 Concrete Pedestrian Ramp (measured by the finished surface area inclusive of monolithic curb and gutter)

.6 Miscellaneous concrete (measured by the finished surface area)

.3 Unit price shall include excavation to proposed subgrade elevation, preparation of subgrade to required density and depth, supply, placement, and compaction of granular base material to required density, and all other materials, equipment, labour and incidentals required to complete the work.

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-A23.4, Precast Concrete - Materials and Construction.

.3 CSA-A266.1, Air Entraining Admixtures for Concrete.

.4 CSA-A3001, Cementitious Materials for Use in Concrete.

.5 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.

2 Products

2.1 MATERIALS

.1 Cement to CAN/CSA-A3001 Cementitious Materials for Use in Concrete

.2 Cement to CAN/CSA-A3001, type GU.

.3 Water and aggregates to CAN/CSA-A23.1.

.4 Air entraining admixture to CAN/CSA-A266.1 and ASTM C260/C260M.

.5 Reinforcing steel to CAN/CSA G30.18, deformed, Grade 400, unless indicated otherwise.

.6 CSA G30.18 Carbon Steel Bars for Concrete Reinforcement

.7 Concrete to CAN3-A23.1, minimum 30 MPa compressive strength at 28 days, for Class A exposure.

.8 Curb anchors: steel dowels or pins to CAN/CSA G30.18, minimum 15 mm diameter x 600 mm length.

2.2 FABRICATION

.1 Fabricate to CAN3-A23.4, precast reinforced concrete parking curbs and New Jersey type traffic barriers as shown on Drawings.

.2 Finish to be standard grade.

.3 Fabricate to location, size and dimension as shown on Drawings.

3 Execution

3.1 INSTALLATION

.1 Install curbs or barriers as directed by the Owner's Representative.

.2 Secure curbs in position by driving steel dowels through precast holes until flush with top of curb.

.3 Rejected, damaged, or defective units shall be removed from site and replaced with sound units.

4 Measurement and Payment

4.1 PRECAST PARKING CURBS AND BARRIERS

.1 Precast reinforced parking curbs and New Jersey type traffic barriers to be measured in number of units supplied and installed in each size and type specified on the Bid Form.

.2 The unit price for precast parking curbs and barriers shall include the supply of the precast concrete, delivery to site, and all labour, equipment, and materials required to complete the installation in accordance with the Drawings and Specifications.

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA-A23.4, Precast Concrete - Materials and Construction.

.3 CSA-A3001, Cementitious Materials for Use in Concrete.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM C67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

.2 ASTM C414, Standard Test Method for Working, Setting, and Service Strength Setting Times of Chemically Setting Chemical-Resistant Silicate and Silica Mortars.

.3 ASTM C936, Standard Specification for Solid Concrete Interlocking Paving Units.

2 Products

2.1 MATERIALS

.1 Granular base to be 20 mm crushed granular base. Gradation to be in accordance with Section 3 04 00 – Aggregate Materials.

.2 Clean sand for levelling course to Section 3 04 00 – Aggregate Materials.

.3 Concrete paving stone:

.1 Manufactured in conformance with ASTM C936.

.2 Thickness

.1 Sidewalk and curb ramp concrete paving stone: 60 mm.

.2 Crosswalk, driveway, and lane crossing concrete paving stones: 80 mm.

.3 Colour: As noted on Drawings.

.4 Physical properties:

.1 Compressive strength: minimum average 55 MPa with no individual unit less than 50 MPa.

.2 Absorption: maximum average 5% with no individual unit greater than 7%.

.5 Freeze-thaw: to ASTM C67.

.6 Abrasion resistance: to ASTM C414.

.7 Permissible variation in dimensions:

.1 Length or width: 1.5 mm.

.2 Thickness: 3 mm.

.8 Edge Restraint:

.1 Pressure treated lumber, concrete strip or preformed PVC edging as indicated on Drawings or approved by the Owner's Representative.

3 Execution

3.1 SUBGRADE PREPARATION

.1 Prepare subgrade for concrete work and brick pavers to Section 3 07 00 – Roadway Embankment and Compaction.

3.2 GRANULAR BASE

.1 **S**ubgrade to be approved before placement of granular base.

.2 Place granular base, to depths detailed on drawings, to Section 3 07 30 – Granular Base.

3.3 EDGE RESTRAINT

.1 In areas not restrained by existing concrete work, place specified edge restraint material as shown on drawings.

3.4 SAND LEVELLING COURSE

.1 Granular base to be approved before placement of sand course.

.2 Place and screed a 25 mm compacted thickness of sand levelling course over area to be paved.

.3 Once screeded and levelled, do not disturb sand levelling course.

3.5 CONCRETE PAVING STONE

.1 Paving stones shall be laid in approved pattern.

.2 Joints between stones not to exceed 3 mm.

.3 Gaps at edge of paved surface shall be filled with standard edge pieces or with stones cut to fit. Stones shall be cut to a straight even surface without cracks or chips.

.4 Paving stones shall be vibrated to their final level by at least two passes of a vibrating plate compactor.

.5 After vibration, sand containing at least 30% - 3 mm particles shall be brushed over surface and vibrated into joints with additional passes of plate vibrator to completely fill joints.

.6 Surplus material shall be swept from surface and disposed of in an approved method/location. Avoid material from entering storm drainage system.

3.6 TOLERANCE

.1 After final vibrating, surface shall be true to grade and shall not vary by more than 8 mm when tested with a 3 m board at any location on surface.

4 Measurement and Payment

4.1 PRECAST PAVING STONES

.1 Precast paving stones shall be measured in square meters (m^2) of paving stones installed in each type specified on the Bid Form.

.2 The unit price for precast paving stones shall include the supply of the precast paving stones, delivery to site, clean sand, and levelling course, and all labour, equipment, and materials required to complete the installation in accordance with the Drawings and Specifications.

.3 Subgrade preparation and granular base course for precast paving stones is not included in the unit price for precast paving stones and will be paid separately.

END OF SECTION

1 General

1.1 SUBMITTALS

.1 Rate of Application to be provided by Contractor in accordance to all regulatory requirements.

2 Products

.1 Supply calcium chloride as 35% aqueous solution.

3 Execution

3.1 APPLICATION

.1 Maintain dust control on worksite, haul routes and other working areas by means of watering, sweeping or any other means necessary to control dust due to work construction.

.2 Contractor to perform work the work in a manner that will not produce an objectionable amount of dust.

.3 Dust shall be monitored at all times by the Contractor and water and/or additional dust control measures shall be applied to assist with the dust control.

.4 Water supply for dust control will be the responsibility of the Contractor.

.5 Contractor to provide dust control log daily to the Owner's Representative. The log shall identify date, time (once per hour), location, dust control measure used and supporting pictures.

4 Measurement and Payment

.1 Include a lump sum for all costs involved with Dust Control on the worksite and on haul routes.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117, Standard Test Method for Materials Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.4 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.5 ASTM E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves.

.2 Canadian General Standards Board (CGSB)

.1 CGSB-8-GP-2M, Sieves, Testing, Woven Wire, Metric

1.2 SOURCE APPROVAL

.1 Source of materials to be incorporated into work or stockpiled requires approval.

.2 Inform Owner's Representative of proposed source of aggregates and provide access for sampling at least 2 weeks prior to commencing production.

.3 If, in opinion of the Owner's Representative, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, locate an alternative source, or demonstrate that material from source in question can be processed to meet specified requirements.

.4 Should a change of material source be proposed during work, notify the Owner's Representative 1 week in advance of proposed change to allow sampling and testing.

.5 Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

1.3 PRODUCTION SAMPLING

.1 Aggregate will be subject to continual sampling by Owner's Representative during production.

.2 Provide Owner's Representative with ready access to source and processed material for purpose of sampling and testing.

.3 Bear the cost of sampling and testing of aggregates which fail to meet specified requirements.

.4 Sieve analysis shall be performed by a qualified material testing laboratory.

1.4 METRIC SIEVES

.1 CGSB 8-GP-2M sieve sizes shall replace ASTM E11 sieves as follows:

CGSB 8-GP-2M Sieves (µm)	ASTM E11 Sieves (mm)
125 000	125.0
80 000	75.0
63 000	63.0
50 000	50.0
40 000	37.5
25 000	25.0
20 000	19.0
16 000	16.0
12 500	12.5
10 000	9.5
5 000	4.75
2 500	2.36
2 000	2.00
1 600	1.70
1 250	1.18
800	0.850
630	0.600
400	0.425
315	0.300
160	0.150
80	0.075
45	0.045

2 Products

2.1 MATERIALS

.1 Type 1 fill (Washed Rock):

.1 Clean, hard, durable, gravel or stone free from clay lumps, cementation, shale, organic material, frozen material, and other deleterious materials.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117 giving a smooth curve without sharp breaks when plotted on semi-log charts.

Sieve Designation (µm)	% Passing
80 000	100
50,000	95 - 100
25 000	20 - 100
20 000	0 – 80
10,000	0 - 10
5 000	0

.2 Native Backfill:

.1 Selected material from excavation or other approved sources shall be unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, organics, refuse or other deleterious materials.

.3 Type 2 fill (Imported Backfill):

.1 Crushed or screened stone, gravel or sand consisting of hard, durable particles free from clay lumps, cementation, organic material, frozen material or other deleterious materials.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117 and have a smooth curve without sharp breaks when plotted on semi-log charts.

Sieve Designation (µm)	% Passing
50 000	100
25 000	55 - 90
5 000	25 - 60
630	2 - 10

.3 The contractor shall submit a complete sieve analysis of two samples of imported backfill material to the Owner's Representative for review, prior to delivery on site.

.4 The sieve analysis shall be performed by a qualified material testing laboratory.

.5 A tolerance of 3% in the amount passing the maximum sieve screen size will be allowed if all the material passed a screen with a 6 mm larger opening.

.4 Pipe Zone Material:

.1 Crushed or screened stone, gravel or sand consisting of hard, durable particles free from clay lumps, cementation, organic material, frozen material or other deleterious materials.

.2 Graduations to be within limits specified when tested to ASTM C136 and ASTM C117 and to have a smooth curve without sharp breaks when plotted on semi-log charts.

Sieve Designation (µm)	% Passing
10 000	100
5 000	95 - 100
2 500	80 - 100
1 250	50 - 85
630	30 - 65
315	10 - 30
160	2 - 10

.5 Crushed aggregate shall consist of sound, hard, durable particles of sand, gravel, and rock free from elongated or laminated particles, injurious amounts of flaky particles, soft shales, coal ironstone, clay lumps, organic material or other deleterious substances.

.6 Flat and elongated particles are those whose greatest dimension exceeds five times their least dimension.

.7 Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:

.1 Natural sand.

.2 Manufactured sand.

.3 Screenings produced in crushing of quarried rock, boulders, gravel, or slag.

.8 Coarse aggregates satisfying requirements of applicable section shall be one of following:

.1 Crushed rock or slag.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

.9 Granular Base

.1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material, and other deleterious materials.

.1 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117 and to have a smooth curve without sharp breaks when plotted on semi-log grading chart.

.2 Granular Base Gradation:

ASTM Sieve Designation (µm)	% Passing
20,000	100
10,000	65 - 86
5,000	45 - 68
1,250	26 - 45
630	19 - 38
315	14 - 30
160	5 - 20
80	2 - 10

.3 The Contractor shall submit a complete sieve analysis of two samples of granular base material to the Consultant for review, prior to delivery on site.

.4 The sieve analysis shall be performed by a qualified material testing laboratory.

.5 The aggregate should be crushed and have a minimum California Bearing Ratio (CBR) of 60.

.6 The coarse fraction of the aggregate should have a percent wear by the Los Angeles abrasion test of not more than 50.

.7 The material passing the 0.4 mm sieve should have a plasticity index of 6 or less.

.8 The material retained on the 5 mm sieve should have a minimum 60 percent by dry mass with at least two fractured faces.

.9 Granular base should be placed in lifts not exceeding 200 mm in compacted thickness with each lift being uniformly compacted to a minimum of 100 percent of Standard Proctor maximum dry density (ASTM D698).

.10 Granular Sub-base:

.1 Clean, hard, durable gravel free from clay, loam, or any other deleterious material.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117 and to have a smooth curve without sharp breaks when plotted on semi-log grading chart.

.3 Granular Sub-base Gradation:

Sieve Sizes (µm)	Total Percent Passing (By Dry Mass)
63,000	100
5,000	25 – 50
80	0 – 10

.4 The Contractor shall submit a complete sieve analysis of two samples of granular base material to the Owner's Representative for review, prior to delivery on site.

.5 The sieve analysis shall be performed by a qualified material testing laboratory.

.6 The aggregate should be crushed and have a minimum CBR of 60.

.7 The coarse fraction of the aggregate should have a percent wear by the Los Angeles abrasion test of not more than 50.

.8 The material passing the 0.4 mm sieve should have a plasticity index of 6 or less.

.9 The material retained on the 5 mm sieve should have a minimum 60 percent by dry mass with at least two fractured faces.

.10 Granular sub-base should be placed in lifts not exceeding 200 mm in compacted thickness with each lift being uniformly compacted to a minimum of 100 percent of Standard Proctor maximum dry density (ASTM D698).

.11 Traffic Gravel:

.1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material, and other deleterious materials.

.1 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117 and to have a smooth curve when plotted on semi-log grading chart.

.2 Gravel Surfacing Aggregate Gradation:

Sieve Size (µm)	% Passing
20,000	100
10,000	35-77
5,000	15-55
1,250	0-30
80	0-12

.3 The Contractor shall submit a complete sieve analysis of two samples of gravel surfacing aggregate material to Owner's Representative for review, prior to delivery on site.

.4 The Sieve analysis shall be performed by a qualified material testing laboratory.

.5 The material passing the 0.4 mm sieve should have a plasticity index of 8 or less.

.6 The material retained on the 5 mm sieve should have a minimum 40 percent by dry mass with at least two fractured faces.

.12 Crushed Concrete:

.1 Crushed concrete that meets the requirements of the following materials is approved for use:

.1 Imported Granular Backfill

.2 Granular Base

.3 Granular Sub-base

3 Execution

3.1 PROCESSING

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates if required to obtain gradation requirements specified by aggregate splitting, climnation of fines, or blending with sand. Use methods and equipment approved by Owner's Representative.

.3 Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.

.4 Wash aggregates, if required to meet specifications. Use only equipment approved by Owner's Representative.

.5 When operating in stratified deposits use excavation equipment and methods that will produce uniform, homogeneous aggregate.

3.2 HANDLING

.1 Handle and transport aggregates to avoid segregation, contamination, and degradation.

3.3 STOCKPILING

.1 Stockpile aggregates on site in locations designated as temporary workspace.

.2 Do not stockpile on completed pavement surfaces where damage to pavement may result.

.3 Stockpile aggregates in sufficient quantities to meet project schedules.

.4 Stockpiling sites shall be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.5 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of the aggregate or, if permitted, stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.

.6 Separate aggregates by substantial dividers or stockpile far enough apart to prevent intermixing.

.7 Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Owner's Representative within 48 hours of rejection.

.8 Stockpile materials in uniform layers of 750 mm maximum thickness.

.9 Complete each layer over entire stockpile area before beginning next layer.

.10 Coning of piles or spilling of material over edges of pile will not be permitted.

3.4 STOCKPILE CLEANUP

.1 Leave stockpile site in a tidy, well drained condition, free of standing surface water.

.2 Remove any unused aggregates from site after the work has been completed.

3.5 RESTORE SITE TO EXISTING CONDITION OR BETTER. QUALITY CONTROL PLAN

.1 Contractor is to furnish copies of the following sieve analyses to ASTM C136 and other tests to ensure that aggregates being produced and supplied meet the specified requirements. Contractor to provide a daily estimate of production tonnage to the Owner's Representative.

.2 Grading of aggregate for stockpile

.1 A minimum of one sieve analysis per 500 tonnes of aggregate shall be performed. Aggregate placed in stockpiles prior to acceptance by the Owner's Representative may be rejected, all or in part.

.2 Evaluation of tests: the average grading of the first 8 consecutive sieve tests shall conform to the specified grading band.

.3 Grading of aggregate shipped direct from the crusher to jobsite.

.1 A minimum of one sieve analysis per 300 tonnes of aggregate will be performed.

.2 Do not ship aggregate to jobsite until the applicable test results have been accepted by the Owner's Representative.

4 Measurement and Payment

.1 No separate payment will be made for work specified in this Section.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)t

.1 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

.2 Canadian Standards Association (CSA)

.1 CAN/CSA – A3000, Cementitious Materials Compendium

2 Products

2.1 PORTLAND CEMENT

.1 Portland Cement: to CAN/CSA – A3000, Type I, normal.

3 Execution

3.1 SUBGRADE CEMENT STABILIZATION

.1 Pregrade and shape soil to designated grade and cross-section prior to beginning the cement stabilization of the subgrade.

.2 Loosen soil to 300 mm depth below subgrade elevation. Work soil with cultivating and mixing equipment until soil is pulverized into no larger than 25 mm pieces, exclusive of stones.

.3 Dust Control: Contain cement dust within site area. Do not spread cement during or when there is imminent danger of high winds or rain.

.4 Spread and blend cement into soil at a rate of 16 to 30 kg per square metre of 300 mm compacted depth.

.5 Add water to blended soil and cement sufficient for best achieving the required compaction. Mix to a homogeneous mixture.

.6 Spread the mixture uniformly in lifts as required to achieve the required density throughout the entire 300 mm depth.

.7 Shape and compact entire roadbed to within 15 mm of design but not uniformly low or high.

.8 Complete compaction and finishing on same day of mixing. The moisture content of the mixture shall be within 2% of the optimum moisture content.

.9 Water may be lightly sprayed with a pressurized distributor for surface finishing.

.10 Leave surface of compacted subgrade slightly higher than required elevation; then trim to indicated crown and grade. Leave finished surface even and free of depressions, humps or loose material.

.11 Maximum Density: as used in this article, is the dry unit mass of sample at optimum moisture content as determined in the laboratory according to ASTM D1557.

.12 Required Density: Minimum 100% of corrected maximum density.

.13 Do not permit vehicular traffic over the stabilized subgrade.

.14 If subgrade floods, drain immediately by natural flow or by pumping.

3.2 QUALITY ASSURANCE

.1 A qualified testing laboratory shall be engaged and paid for by the Contractor to perform all quality control tests. Copies of test results shall be sent directly to the Contractor and Owner's Representative.

4 Measurement and Payment

4.1 CEMENT STABILIZED SUBGRADE

.1 Cement Stabilized Subgrade will be paid for by the square meter (m^2) for the depth indicated as measured and approved by the Owner's Representative.

.2 The unit rate shall include all labour, equipment and materials required to scarify the subgrade to the appropriate depths, supply and addition of cement as specified, addition of water, compaction of the subgrade to the required densities and depths as detailed.

.3 No payment shall be made for reworking and compaction of areas that to do not meet the minimum compaction densities.

END OF SECTION

1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

.2 ASTM D4101, Standard Specification for Polypropylene Injection and Extrusion Materials.

.3 ASTM D4218, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

.4 ASTM D5262, Standard Test Method for Evaluating the Unconfined Tension Creep Behaviour of Geosynthetics.

.5 ASTM D6637, Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.

.6 ASTM D4354, Standard Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing

1.2 SUBMITTALS

.1 Certificates:

.1 Submit copies of mill test data and certificate 4 weeks prior to start of Work.

.2 The specifications on the Mill or Manufacturer's Certificate shall be provided in the same units as specified in these Specifications.

1.3 DELIVERY AND STORAGE

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, water, mud, soil, dust, debris, and rodents.

2 Products

2.1 DESCRIPTION

.1 Open grid polymer geosynthetic having uniaxial orientation, free of striations, roughness, pinholes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. The geosynthetic must be manufactured with fibers consisting of long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins or polyesters. They must form a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.

2.2 APPROVED MATERIALS

.1 Stratagrid 200 by Strata Systems Inc.

.2 Tensar UX1500HS by Tensar International Corporation.

.3 Tencate Miragrid 5XT by Tencate Geosynthetics North America.

.4 Fortrac by HUESKER Inc.

.5 Tensar TriaAx by Tensar International Corporation

2.3 QUALITY CONTROL

.1 Manufacturing Quality Control: Testing must be performed at a laboratory accredited by GAI-LAP for tests required for the geosynthetic, at frequency meeting or exceeding ASTM D 4354.

.2 Ultraviolet Stability must be verified by an independent laboratory on the geosynthetic or a geosynthetic of similar construction and yarn type.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for soil stabilization installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Owner’s Representative.

.2 Inform Owner’s Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 INSTALLATION

.1 Place geogrid material by unrolling onto graded surface in manner and locations indicated and retain in position in accordance with manufacturer's written recommendations.

.2 Place geogrid on sloping surfaces in one continuous length from toe of slope to upper extent of geogrid.

.3 Overlap each successive strip of geogrid 600 mm over previously laid strip.

.4 Join successive strips of geogrid as recommended by manufacturer.

.5 Protect geogrid from displacement, damage, or deterioration before and during placement of overlaid aggregate, geotextiles and soil layers.

.6 After installation, cover with overlay layer within 10 days of placement.

.7 Replace damaged or deteriorated geogrid to approval of Owner’s Representative.

.8 Place and compact soil layers in accordance with Section 2 01 00 - Excavating Trenching and Backfilling.

3.4 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management:

.1 Remove waste and recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Vehicular traffic not permitted directly on geogrid.

.2 Do not overload soil or aggregate covering on geogrid.

4 Measurement and Payment

4.1 GEOGRID SOIL REINFORCEMENT

.1 Geogrid soil reinforcement will be measured in square metres (m^2) based on the finished reinforced surface.

.2 The unit price bid shall include full compensation for:

.1 Supply, storage, and handling of materials.

.2 Installation of geogrid in accordance with the Construction Specifications and the manufacturer's instructions.

.3 All other related work for the supply and installation of geogrid soil reinforcement.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
.2 ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
.3 ASTM D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
.4 ASTM D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
.5 ASTM D4716, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
.6 ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
.7 ASTM D4833, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
.8 ASTM D6241, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50 mm Probe.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No. 11.2, Textile Test Methods - Bursting Strength - Ball Burst Test.
.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
.1 No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
.2 No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
.3 No.6.1, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
.4 No.7.3, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
.5 No. 10, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

.3 Canadian Standards Association (CSA)

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.2 MILL CERTIFICATES

.1 Submit to Owner's Representative copies of mill test data and certificate at least 4 weeks prior to start of work.

.2 The specifications on the Mill or Manufacturer's Certificate shall be provided in the same units as specified in these Specifications.

1.3 DELIVERY AND STORAGE

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, water, mud, soil, dust, debris, and rodents.

2 Products

2.1 MATERIAL

.1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls.

.1 Width: 3.80 m minimum.
.2 Length: 109 m minimum.
.3 Seams: lapped in accordance with manufacturer's recommendations

.2 Physical properties – Non-woven:

.1 Tensile strength and elongation (in any principal direction): to ASTM D4632.
.1 Tensile strength: minimum 912 N, wet condition.
.2 Elongation at break: maximum 50%
.3 Static CBR Puncture D6241: 2336 N

.2 Acceptable Material: Nilex "Non-Woven" geotextile No. 4553 or an approved equivalent.

.3 Geotextile: woven synthetic fibre fabric supplied in rolls.

.1 Width: 5.49 m minimum
.2 Length: 76.2 m minimum
.3 Seams: Lapped in accordance with manufacturer's recommendations.

.4 Physical Properties – Woven:

.1 Tensile strength and elongation (in any principal direction): to ASTM D4632.
.1 Tensile strength: minimum 4702 N
.2 Grab Elongation: 12% minimum.
.3 Static CBR Puncture D4833: 4005 N

.2 Acceptable Material: Nilex "Woven" geotextile No. 2006 or an approved equivalent.

3 Execution

3.1 INSTALLATION

.1 Place geotextile material of the type as indicated on the drawings as per manufacturer's instructions.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles, and creases.

.3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.

.4 Join successive strips of geotextile by sewing longitudinal joint with 200 mm overlap (if required) at the place of manufacture or, by overlapping (400 mm) and pinning joints perpendicular to roadway centreline in accordance with manufacturer's recommendations.

.5 Protect installed geotextile material from displacement, damage, or deterioration before, during and after placement of material layers.

.6 After installation, cover with overlying layer within 4 h of placement.

.7 Replace damaged or deteriorated geotextile to approval of Owner's Representative.

3.2 PROTECTION

.1 Do not permit the passage of any vehicle directly on geotextile at any time.

.2 Do not overload soil or aggregate covering on geotextile.

4 Measurement and Payment

4.1 GEOTEXTILE

.1 Geotextiles are to be measured in square metres (m^2).

.2 The unit price bid shall include full compensation for:

.1 Supply, storage, and handling of materials.
.2 Installation of geotextiles in accordance with the Construction Specifications and the manufacturer's instructions.
.3 All other related work for the supply and installation of geotextiles.

END OF SECTION

1 General

1.1 DELIVERY AND STORAGE

.1 During delivery and storage, protect insulation from direct sunlight, physical damaged and incompatible chemicals (solvents, petroleum products, etc.). On the job site, cover temporarily stored insulation with a light-coloured tarpaulin. Insulation must not be exposed to flame or other ignition source.

2 Products

2.1 STYROFOAM INSULATION

.1 Styrofoam H1-40 as manufactured by Dow Chemical Canada Inc. or approved equal.

.2 Thickness as indicated on the Drawings.

3 Execution

3.1 UTILITY MAIN INSULATION

.1 Install soil insulation in accordance with manufacturer's instructions.

.2 Backfill to be finished smooth.

.3 Backfill and compact trench in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.2 ROADWAY INSULATION

.1 Place soil insulation as shown on the Construction Drawings. To prevent wind blow-off, pin in place with wooden skewers or weigh down with granular material.

.2 Place and compact first lift of granular sub-base material carefully to prevent damage or displacement.

.3 Place subsequent lifts of granular material and asphalt as required to complete the work.

3.3 PROTECTION

Do not permit passage of any vehicle directly on soil insulation at any time.

3.4 QUALITY ASSURANCE

.1 Notify the Owner's Representative to review the placement of soil insulation before covering the insulation with granular material.

4 Measurement and Payment

4.1 SOIL INSULATION

.1 Soil insulation shall be measured in in square metres (m^2) of soil insulation installed for each insulation thickness specified in the Bid Form.

.2 The unit rate for soil insulation shall include the supply and installation of soil insulation materials. The unit rate shall include all materials, equipment, and labour to complete the installation of soil insulation in accordance with this Section and the Drawings.

END OF SECTION

1 General

1.1 REFERENCES

.1 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m3)).

.2 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

1.2 SUBMITTALS

.1 Submit to Owner's Representative, at least (4) four weeks in advance, location of borrow source for embankment material.

1.3 DEFINITIONS

.1 Rock Excavation: excavation of:

.1 Material from solid masses of igneous, sedimentary, or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort from Caterpillar D9L or equivalent to be considered integral with parent mass.

.2 Boulder or rock fragments measuring in volume one (1) cubic meter or more.

.2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping.

.3 Unclassified Excavation: excavation of whatever character other than stripping encountered in the work.

.4 Free Haul: distance that excavated material is hauled without compensation. Free haul distance to be 0.5 km.

.5 Stripping: excavation of organic material covering original ground.

.6 Overhaul: authorized hauling more than free haul distance that excavated material is moved.

.7 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.

.8 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.

.9 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.

.10 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 Adhere to regulations of authority having jurisdiction if blasting is required.

.2 Always adhere to Provincial and National Environmental requirements and if potentially toxic materials are involved.

1.5 BURIED SERVICES

.1 Check with utility companies to locate or advise regarding buried pipes, cables, ducts, or services. Make good and pay for repair to services damaged during excavation.

2 Products

2.1 MATERIALS

.1 Embankment materials require approval of Owner's Representative.

.2 Material used for embankment not to contain organic matter, frozen lumps, weeds, sod, roots, stumps, or any other objectionable matter.

3 Execution

3.1 EQUIPMENT

.1 Compaction equipment must be capable of obtaining required densities in materials on project.

3.2 WATER DISTRIBUTORS

.1 Apply water with equipment capable of uniform distribution.

3.3 EXCAVATING

.1 General:

.1 Advise Owner's Representative sufficiently in advance of excavation operations for initial cross sections to be taken.

.2 Maintain crowns and cross slopes to provide good surface drainage.

.3 Where subgrade is on transition from excavation to embankment treat ground slopes at grade points as directed by Owner's Representative.

.4 Dispose of waste material at approved disposal site.

.2 Unsuitable materials:

.1 Notify Owner's Representative whenever unsuitable materials are encountered in cut sections. Remove materials unsuitable for embankments to lateral limits and depths directed by Owner's Representative.

.2 Unsuitable materials excavated to be disposed of as indicated at approved disposal site.

.3 Borrow:

.1 Completely use in embankments, suitable materials removed from excavations before taking material from borrow areas.

.2 Provide additional suitable embankment material as required to complete work.

.3 Remove waste and stripping material from borrow pits to designated locations.

.4 Trim and leave borrow pits in condition to permit accurate measurement of material removed.

.4 Rock excavation:

.1 If, during excavation, material appearing to conform to classification for rock is encountered, notify Owner's Representative.

.2 Submit plan for review by Owner's Representative indicating methods proposed for removal of rock bed.

.3 Undertake methods that reduce overbreak, increase stability of all rock faces, and control blasting to minimize flying particles.

3.4 EMBANKMENTS

.1 Where indicated or directed by Owner's Representative, scarify or bench existing slopes on side hill or sloping sections to ensure a proper bond between new materials and existing surfaces. Obtain prior approval of method to be used from Owner's Representative.

.2 Do not place material which is frozen nor place material on frozen surfaces.

.3 Maintain a crowned surface during construction to ensure ready run-off of surface water.

.4 With material containing less than 10% by volume of stone or rock fragments larger than 100 mm:

.1 Place and compact to full width in uniform layers not exceeding 200 mm compacted thickness.

.2 Compact to 100% Standard Proctor Density.

.3 Bring moisture content of soil to level required to achieve specified compaction. Add water or aerate as required.

3.5 SUBGRADE PREPARATION

.1 In areas where excavation is to subgrade or in any case less than 300 mm below that elevation, the subgrade will be scarified to a depth of 300 mm and the scarified material windrowed to the side.

.2 Subgrade to be finished to the road profile elevations as detailed on the drawings.

.3 The exposed surface shall then be brought to its optimum moisture content and compacted to 100% of Standard Proctor Density ASTM D698.

.4 The windrowed material shall then be brought to its optimum moisture content, shaped to line and grade, and compacted to 100% of Standard Proctor Density ASTM D698.

3.6 SUBGRADE CEMENT STABILIZATION

.1 Refer to Section 3 05 10 – Portland Cement Stabilized Subgrade.

3.7 FINISHING

.1 Remove soft or other unstable material that will not compact properly and fill resulting depressions with material approved by Owner's Representative.

.2 Shape and compact entire roadbed to within 15 mm of design elevations but not uniformly high or low.

.3 Do scarifying, blading, compacting or other methods of work as necessary to provide thoroughly compacted roadbed shaped to grades and cross sections indicated or directed.

.4 Finish back and side slopes of common material to neat condition, suitable for seeding, true to line and grade.

.1 Remove boulders encountered in cut slopes and fill resulting cavities.

.2 Hand finish slopes that cannot be finished satisfactorily by machine.

3.8 PROOF ROLLING

.1 Proof roll as per Sections 3 07 20 Granular Sub-Base and 3 07 30 Granular Base.

3.9 MAINTENANCE

.1 Maintain finished surfaces in a condition conforming to this section until acceptance.

3.10 QUALITY ASSURANCE

.1 A qualified testing laboratory shall be engaged and paid for by the Contractor to perform all soil compaction tests. Copies of test results shall be sent directly to the Contractor and Owner's Representative.

.2 The testing laboratory will take a minimum of one field density test for each 1000 m^2 of compacted subgrade lift according to appropriate procedures.

.3 The testing frequency above will increase to reflect any changes in subgrade material.

.4 A proof roll of the finished subgrade will be required to confirm adequate bearing capacity of the subgrade soils. The proof roll shall be supervised and must be performed in accordance with the Owner's Representative's recommendations

4 Measurement and Payment

.1 Common Excavation for roadway embankment shall be paid for by the cubic meter (m^3). Volumes will be measured using survey cross section for material compacted in place. Price to include, all equipment, materials, labour, excavation, loading, hauling, cleanup and incidentals required to complete the work as specified.

.2 Borrow for roadway embankment shall be paid for by the cubic meter (m^3). Volumes will be measured using survey cross section for material compacted in place. Price to include, third party testing for material approval, all equipment, materials, excavation, loading, hauling, cleanup labour, and incidentals required to complete the work as specified.

.3 Subgrade Preparation shall be paid for by the square meter (m^2) for the depths indicated on the bid form and drawings and measured by the finished surface area prepared. Price to include all labour, equipment, materials, and incidentals required to prepare the subgrade to the depths and densities indicated, rework for any areas not meeting the minimum requirements.

.4 Rock excavation shall be paid for by the cubic meter (m^2). Volumes will be measured using survey cross section of rock bed prior to and after rock has been removed. Price to include all preparation, permits, approvals, testing, equipment, labour, and incidentals required to remove and dispose of the rock.

.5 Waste Excavation shall be paid in for by the cubic meter (m^3). Volumes will be measured by field survey. Price to include all equipment, materials, labour, excavation, loading, hauling and the disposal of material at an off-site location approved by the Regional Municipality of Wood Buffalo. Alternative sites will be considered at the request of the Contractor. No extra payment will be made for excavation beyond the limits identified by the Engineer.

.6 Contaminated Material Disposal shall be paid for by the cubic meter (m^3). Volumes will be measured by field survey. Price to include all equipment, materials, labour, excavation, loading, hauling and the disposal of material identified as contaminated which require off-site disposal and are not accepted at the RMWB landfill site. No extra payment will be made for excavation beyond the limits identified by the Engineer.

.7 No extra payment shall be made for areas that do not meet the project specifications and require reworking.

.8 No extra payment will be made for areas requiring reworking due to inclement weather.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C 131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
.2 ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
.3 ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600kN-m/m3)).
.4 ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

2 Products

2.1 MATERIALS

.1 Granular base material: to Section 3 04 00 – Aggregate Materials and following requirements:

3 Execution

3.1 SEQUENCE OF OPERATION

.1 Scarifying and reshaping

.1 Trim roadbed and remove contaminated materials to depth indicated unless directed otherwise by Owner's representative. Dispose of excess material.
.2 Scarify roadbed to width as indicated unless directed otherwise Owner's Representative.
.3 Blade and trim pulverized material to elevation and cross section dimensions as indicated unless directed otherwise by Owner's representative.
.4 Where deficiency of material exists, add and blend in new granular base material as directed by Owner's representative. Ensure no frozen material is used.

.2 Compacting

.1 Compaction equipment to be capable of obtaining required material densities.
.2 Compact to density not less than 100% corrected maximum dry density in accordance with ASTM D 698.
.3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
.4 Apply water as necessary during compaction to obtain specified density.
.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved capable of obtaining required densities.

.3 Repair of soft areas

.1 Correct soft areas by removing defective material to depth and extent directed by Owner's Representative. Replace with material acceptable to Owner's Representative and compact to specified density.

3.2 SITE TOLERANCES

.1 Reshaped compacted surfaces to be within plus or minus 10 mm of elevation as indicated.

4 Measurement and Payment

.1 Reshaping existing roadbed will be measured in square metres (m^2) for the surface accepted by the Owner's Representative. Price to include all material, labour, equipment, and incidentals required to complete the work as specified.

.2 No extra payment will be made for areas that require rework due to failed densities.

.3 Additional granular base material will be measured in tonnes of material incorporated into work. Contractor shall provide weight scale tickets at the end of each working day. Failure to submit tickets will result in nonpayment.

END OF SECTION

1 General

This Section specifies requirements for supplying, producing, placing and compacting granular sub-base to lines, grades and typical cross sections indicated on plans or as directed by Owner's Representative.

1.1 DEFINITIONS

.1 Sub-base: Design depth of granular material constructed immediately on the prepared subgrade and prior to construction of base material.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117, Standard Test Method for Materials Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C131, Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)) .

.5 ASTM D1556, Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method

.6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.7 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

.8 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.9 ASTM D2167, Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

.10 ASTM D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.1, Sieves Testing, Woven Wire.

.2 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

2 Products

2.1 MATERIALS

.1 Granular sub-base material: in accordance with Section 3 04 00 – Aggregate Materials.

3 Execution

3.1 INSPECTION OF UNDERLYING SUB-BASE OR SUBGRADE

.1 Do not place granular base until finished sub-grade or sub-base surface is inspected and approved by Owner's Representative.

3.2 PLACING

.1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.

.2 Place using methods which do not lead to segregation or degradation of aggregate.

.3 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Owner's Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

.4 Shape each layer to a smooth contour and compact to specified density before succeeding layer is placed.

.5 Remove and replace that portion of a layer in which material becomes segregated during spreading.

3.3 COMPACTING

.1 Compact to density not less than 100% of Standard Proctor Density ASTM D698 at optimum moisture content for 300 mm depth base course.

.2 Shape and roll alternately to obtain a smooth, even, and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

.5 The top of the finished base shall exhibit a smooth, continuously dense surface.

3.4 FINISH TOLERANCES

.1 Finished base surface shall be within plus or minus 10 mm of established grade but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 QUALITY CONTROL

.1 For proof rolling use roller of 45,400 kg gross mass with four pneumatic tires each carrying 11,350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 915 mm maximum.

.2 Owner's Representative may authorize use of other acceptable proof rolling equipment.

.3 Proof roll top of subgrade, sub-base, and base upon completion of fine grading and compaction.

.4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.5 Testing Frequency.

.1 A qualified testing laboratory shall be engaged and paid for by the Contractor to perform all compaction tests. Copies of the test results shall be sent directly to the Contractor and Owner's Representative.

.2 The material testing laboratory will take a minimum of one field density test on compacted granular base for each lift for each 1,500 m^2 of road, 1,000 m^2 of alley, 500 m^2 of walk, monolithic walk, curb ramp, alley crossing, commercial crossing, private crossing, or median island strip according to ASTM D1556, ASTM D2167 or ASTM D6938 for comparison with maximum dry density.

.3 The testing frequency above will increase to reflect any changes in granular sub-base material.

3.6 MAINTENANCE

.1 Maintain finished base in a condition conforming to this section until succeeding material is applied.

4 Measurement and Payment

4.1 GRANULAR SUB-BASE

.1 Granular sub-base will be measured in square metres (m^2) of compacted material to the depth specified on Bid Form.

.2 The unit price shall include full compensation for the supply and installation of granular sub-base materials.

4.2 ADDITIONAL GRANULAR SUB-BASE TO REPLACE UNSUITABLE

.1 Additional granular sub-base to replace unsuitable will be measured in cubic metres (m3) of in place compacted material.

.2 The unit price shall include full compensation for excavation, removal and disposal of unsuitable material if not covered elsewhere, the supply and installation of additional granular sub-base materials.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C131, Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.5 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.6 ASTM D1556, Standard Test Method for Density and Unit Weight of Soil in Place by Sand Cone Method.

.7 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3).

.8 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.9 ASTM D2167, Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

.10 ASTM D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves Testing, Woven Wire.

.2 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

2 Products

2.1 MATERIALS

.1 Granular base material: in accordance with Section 3 04 00 – Aggregate Materials.

3 Execution

3.1 INSPECTION OF UNDERLYING SUB-BASE OR SUBGRADE

.1 Do not place granular base until finished sub-grade or sub-base surface is inspected and approved by Owner's Representative.

3.2 PLACING

.1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.

.2 Place using methods which do not lead to segregation or degradation of aggregate.

.3 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Owner's Representative may authorize thicker lifts (layers) if specified compaction can be achieved.

.4 Shape each layer to a smooth contour and compact to specified density before succeeding layer is placed.

.5 Remove and replace that portion of a layer in which material becomes segregated during spreading.

3.3 COMPACTING

.1 Compact to density not less than 100% of Standard Proctor Density ASTM D698 at optimum moisture content for 300 mm depth base course.

.2 Shape and roll alternately to obtain a smooth, even, and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

.5 The top of the finished base shall exhibit a smooth, continuously dense surface.

3.4 FINISH TOLERANCES

.1 Finished base surface shall be within plus or minus 10 mm of established grade but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 QUALITY CONTROL

.1 For proof rolling use Tandem axle, dual wheel dump truck, with tire pressure not less than 90% of the manufacturers maximum recommended inflation with minimum gross weight of 24,800kg.

.2 Operate the proof roll pattern so that all areas are loaded with at least one pass of the proof rolling vehicle.

.3 Rework any areas with discernible rutting and deflection.

3.6 TESTING FREQUENCY.

.1 A qualified testing laboratory shall be engaged and paid for by the Contractor to perform all soil compaction tests. Copies of test results shall be sent directly to the Contractor and Owner's Representative.

.2 The material testing laboratory will take a minimum of one field density test on compacted granular base for each lift for each 1500 m^2 of road, 1000 m^2 of alley, 500 m^2 of walk, monolithic walk, curb ramp, alley crossing, commercial crossing, private crossing, or median island strip according to ASTM D1556, ASTM D2167 or ASTM D6938 for comparison with maximum dry density.

.3 The testing frequency above will increase to reflect any changes in granular base material.

3.7 MAINTENANCE

.1 Maintain finished base in a condition conforming to this section until succeeding material is applied or until acceptance by Owner's Representative.

4 Measurement and Payment

4.1 GRANULAR BASE

.1 Granular base will be measured in square metres (m^2) of compacted material to the depth specified on the Bid Form. The unit price shall include full compensation for all materials, equipment, and labour required for the installation of granular base materials.

4.2 ADDITIONAL GRANULAR BASE TO REPLACE UNSUITABLE

.1 Additional granular base to replace unsuitable will be measured in cubic metres (m3) of in place compacted material.

.2 The unit price shall include full compensation for excavation, removal and disposal of unsuitable material if not covered elsewhere, the supply and installation of additional granular base materials.

END OF SECTION

1 General

1.1 REFERENCES

.1 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

.2 ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

.3 ASTM D1559, Test Method for Resistance of Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

.4 ASTM C127, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate

.5 ASTM C128, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate

.6 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures

1.2 SUPPLY OF MATERIALS

.1 Notify Owner's Representative of proposed date for use of materials; order and schedule delivery of materials to coincide with construction schedule.

1.3 SOURCE SAMPLING

.1 At least 2 weeks prior to commencing work inform Owner's Representative of proposed source of aggregates and provide access for sampling.

1.4 SUBMISSION

.1 Submit asphalt concrete mix design and trial mix test results to Owner's Representative for approval prior to commencing work. A qualified testing laboratory shall be engaged and paid for by the Contractor to prepare the mix design.

2 Products

2.1 MATERIALS

.1 Asphalt cement:

.1 The asphaltic cement shall be uniform in character, free of water, and shall not foam when heated to 175◦C. It shall meet the following specifications.

	AASHTO Test Method	ASTM Test Method	Specs.
Absolute viscosity at 60°C 30 cm vacuum, poises	--	D2171	500+
Penetration, 25°C, 100 g, 5 sec.	T49	D5	150 - 200
Flash point (Cleveland open cup °C	T48	D92	205+
Thin film oven test	T179	D1754	
Penetration after test, 25°C 100g, 5 sec., % of original	T49	D5	40+
Ductility at 25°C	T51	D113	100+
Solubility in Carbon Tetrachloride	T44	D2042	99.5+

.2 Asphalt Prime Coat

.1 As in Section 3 08 20 – Asphalt Prime Coat.

.3 Asphalt Tack Coat

.1 As in Section 3 08 21 – Asphalt Tack Coat.

.2 Aggregate material:

.1 The Contractor shall be responsible for the acquisition of aggregates and access to the aggregate source.

.2 All aggregate particles shall be clean and durable and shall not contain clay particles or other objectionable aggregations of fine materials.

.3 The aggregate shall be crushed gravel and 60% of the material retained on the 5.00 mm sieve shall have at least two crushed faces.

.4 When tested by means of laboratory sieves, the mixed aggregate shall meet the following gradation limits:

Sieve Size (µm)	
12500	100
10000	83-92
5000	55-70
1250	26-45
630	18-38
315	12-30
160	8-20
80	4-10
% Fractures by dry mass (+ 5 mm, 2 faces)	60 min.
L.A. Abrasion (% loss, coarse aggregate)	40 max.
% Manufactured Fines (-5 mm material)	50 min.

.5 A maximum of 2% oversize shall be allowed on the top sieve size. Coarse aggregate is all material retained on 5.0 mm sieve. This aggregate shall consist of sound crushed stone, crushed gravel, or combinations of these materials. All coarse aggregate shall be free from coatings of clay, silt, or other objectionable matter. The percentage of wear of coarse aggregate used in surface coarse mixes shall not be greater than 40% when tested by ASTM C131 for heavy duty pavements. Coarse aggregate shall be tested for soundness by ASTM C88, or will have been satisfactorily proved sound through adequate record of service. When tested for soundness, the number of cycles shall be five, the solution shall be sodium sulphate, and the maximum loss shall be 12%. Aggregates having known polishing characteristics shall not be used in mixes for the surface course.

.6 When coarse aggregate grading is such that the material will tend to segregate in stockpiling or handling, such aggregate shall be supplied in two or more sizes. Each size of coarse aggregate required to produce the combined gradation specified above, shall be placed in individual stockpiles satisfactory to the Owner's Representative. When it is necessary to blend two or more coarse aggregates before placing them in the cold bins, the blending shall be done through separate bins at the cold elevator feeders and not in the stockpile.

.7 Fine aggregate is all mineral matter passing the 5.0 mm sieve. It shall consist of natural sand and/or manufactured material derived by crushing of stone, slag, or gravel. The aggregate particles shall be clean, tough, durable, moderately sharp, and free from coatings of clay, silt or other objectionable matter and shall contain no clay balls or other aggregations of fine material. Fine aggregates shall be tested for soundness in accordance with ASTM C88 or shall have a satisfactory soundness record. When tested for soundness, the number of cycles shall be 5, the solution shall be sodium sulphate and the maximum loss shall be 16%.

.8 When it is necessary to blend fine aggregates from one or more sources to produce the combined gradation specified, each source or size of fine aggregates shall be placed in individual stockpiles at the plant site and separated by bulkheads or other means satisfactory to the Owner's Representative. The blending shall be done through separate bins at the cold elevator feeders and not in the stockpile.

.9 The combined aggregate shall have a minimum sand equivalent of 45 and a maximum Plasticity Index of 4.

.10 If the Contractor elects to use an approved drier-drum asphalt mixing process, the designated aggregates shall be split on the 5.0 mm sieve size and each material shall be stockpiled separately such that intermixing of each size and type does not occur. The coarse aggregate stockpile shall contain no more than 20% passing the 5.0 mm sieve size and the fine aggregate stockpile shall contain no more than 20% retained on the 5.0 mm sieve size. At least 2,000 tonnes of aggregate shall be placed in each stockpile prior to the start of mixing operations.

.11 The Contractor, during the crushing and splitting process, shall provide a convenient means for accurately and representatively:

.1 sampling the individual coarse and fine aggregate streams, and the combined aggregate stream in its proper proportion, or

.2 sampling the individual coarse and fine aggregate streams and weighing the total amounts of both coarse and fine materials being produced.

.12 Crushed aggregate shall contain a minimum of 2 crushed faces on at least 60% of the material retained on the 5.0 mm sieve on a dry mass basis.

.3 Mineral filler:

.1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.

.2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed to improve mix properties.

.3 Mineral filler to be dry and free flowing when added to aggregate.

.4 When tested by means of laboratory screens, the mineral filler shall have zero plasticity index and meet the following gradation limits:

Sieve Size (µm)	% Passing by Weight
400	100
160	90 minimum
80	70 minimum
45	62 minimum

2.2 MIX DESIGN

.1 Mix Design and Job Mix Formula

.1 A qualified testing laboratory engaged and paid for by the Contractor shall be employed to prepare a mix design and job mix formula for aggregate on which the bid is based. If the Contractor proposes to use a material which does not conform to the aggregate gradation limitations specified, a preliminary mix design shall accompany the bid submission. The mix design and job mix formula shall be submitted and receive the Owner's Representative's approval prior to paving. No paving shall commence before the Owner's Representative's approval is given for the mix design or job mix formula.

.2 Design of mix: by Marshall method to requirements below and as directed by Owner's Representative.

.1 Mix Properties:

Max size of aggregate (mm)	12.5
No. of Blows (each end of specimen)	75 (Arterials/Collectors)
	50 (Locals, Lanes, Trails and Parking Lots)
Stability (K_n)	8
Flow (mm)	2 - 3.5
% Air Voids in Total Mix	3.5 - 4.0
% Voids in Mineral Aggregate	13.5 – 14.0
% Retained Stability	70

.2 Measure physical requirements as follows:

.1 Marshall load and flow value: to ASTM D1559.

.2 Compute void properties on basis of bulk specific gravity of aggregate (to ASTM C127 and ASTM C128). Make allowance for volume of asphalt absorbed into pores of aggregate.

.3 Air voids: to ASTM D3203.

.3 Do not change job-mix without prior written approval of Owner's Representative. Should change in material source be proposed, new job-mix formula to be approved by Owner's Representative in writing.

.3 The job mix formula shall be posted in a conspicuous place within the sight of the plant operator. Any subsequent changes must be approved by the Owner's Representative in writing.

.4 The job mix formula shall list the following information:

.1 Batch Plants

.1 The sieve analysis of the combined aggregate in the mix.

.2 The aggregate size range in each bin separation to be used.

.3 The weight of the material to be used from each bin for one batch of mix.

.4 The weight of the asphalt to be used in each batch.

.5 The mixing temperature of the asphalt mix as determined from the temperature-viscosity relationship for the asphalt.

.2 Continuous Plant

.1 Proportions for a continuous feed mixing plant shall be determined on the basis of a field trial which shall be carried out at least 48 hours prior to placing the mix on the job site.

.2 The volumetric settings of the aggregate and asphalt shall be determined by the Contractor and approved by the Owner's Representative. These settings shall be interlocked, so that a change in the volume of aggregate automatically results in a corresponding change in the volume of asphalt.

.3 The following data shall be displayed at the plant:

.1 The weight of asphalt per tonne of mix.

.2 The mixing temperature of the asphalt mix as determined from the temperature-viscosity relationship for the asphalt.

.3 The settings of the feed systems.

3 Execution

3.1 CONTROL OF MIX

.1 Mixing tolerances:

.1 Permissible variation in aggregate gradation from job mix:

	percent of total mass
5,000 µm sieve and larger	+5.0
2,000 µm sieve	+4.0
630 µm sieve	+3.0
80 µm sieve	+2.0

.2 Permissible variation of asphalt cement from job mix, 0.30%.

.3 Permissible variation of mix temperature at discharge from plant, 9°C.

.4 In no case shall the mixing temperature exceed the maximum temperature indicated from the asphalt temperature - viscosity curve data.

3.2 HOT MIX PLANT

.1 Hot Mix Plant

.1 The paving plant shall be of a type capable of consistently meeting or exceeding all of the requirements of these specifications.

.2 The plant shall be equipped with devices to allow samples to be taken of asphalt cement and aggregates, and shall indicate the temperature of the aggregate, asphalt cement, and mixtures. The Owner's Representative shall have access at any time to all parts of the plant for verifications of weights or proportions.

3.3 PREPARATION AND MIXING

.1 Preparation of Mineral Aggregate

.1 For Pugmill Type Mixers

.1 The aggregate may be blended either through a cold feed proportioning unit or by other means, but in any case, shall be screened into bins in accordance with the aggregate sizes called for in the job mix formula.

.2 The mineral aggregate shall be dried to a maximum moisture content of 0.5%. The temperature of the aggregate, when delivered to the mixing unit, shall be at a temperature which is consistent with proper mixing and laying and in no case above 150°C.

.2 For Dryer-Drum Type Mixers

.1 Each aggregate size shall be fed through a separate feeder which has a positive feed, and which can be easily and accurately calibrated. Each feeder shall be quick adjusting and shall maintain a uniform, constant flow throughout the range of its calibration. The plant shall be equipped with an aggregate cold feed control, such as a belt scale or other device, which automatically and instantly regulates the feed gates, and which has an automatic, positive coupling with the bitumen flow to maintain the required asphalt content. The mineral aggregate shall be dried to a maximum moisture content of 0.5%. The temperature of the aggregate, when delivered to the mixing unit, shall be at a temperature which is consistent with proper mixing and laying and in no case above 150°C. Removal or addition of any size of aggregate, to attain gradation requirements, shall be done at the initial crushing and stockpiling stage. The cold feed control and bitumen flow shall be calibrated to the job mix formula.

.2 Preparation of Binder

.1 The asphaltic binder shall be heated to a temperature between 120°C and 150°C by approved means designed to obtain uniform heating of the entire contents of the storage tank. The temperature differential between aggregate and asphalt binder shall be no more than 15°C.

.3 Mixing

.1 For Pugmill Type Mixers

.1 The mineral aggregate and asphaltic binder shall be mixed to produce a homogeneous mixture in which all particles of the mineral aggregate are uniformly coated and, in the proportions, called for in the approved job mix formula. The volume of mineral aggregate and asphalt cement shall not be so great as to extend above the tips of the mixer blades when the blades are in a vertical position. After the hot aggregate and mineral filler have been charged into the mixer and thoroughly mixed for a period of not less than 15 seconds, the asphaltic binder shall be added, and the mixing continued for a period of at least 20 seconds and not more than 45 seconds.

.2 For Dryer-Drum Type Mixers

.1 The dryer-drum mixer mixing process shall produce uniform mixture in which all aggregate particles are thoroughly asphalt coated. The plant shall be equipped with an automatic, positive coupling which instantly regulates the aggregate cold feed gates with the bitumen flow to maintain the required asphalt content.

.4 Prior to laying mix, clean surfaces of loose and foreign material.

.5 Prior to laying mix, adjust manhole and catchbasin frames, valves, valve boxes and other street hardware to finished/design elevations.

3.4 PREPARATION

.1 Base Preparation

.1 The hot asphaltic mixture shall be laid upon a dry firm base, true to grade and cross-section and free from all screenings, loose, or foreign material. No hot mix shall be spread when the base is wet or when other conditions prevent proper spreading, finishing or compaction.

.2 If undercutting, and subsequent backfill with hot asphaltic concrete is done, the backfill operation shall be performed sufficiently far ahead of the paving operation to allow the asphaltic concrete sufficient time to cool down to support equipment.

.3 Apply diluted emulsion (prime coat) at a rate of approximately 1.5 L/m^2. Paint contact surfaces of curbs, gutters, headers, manholes, catchbasins and like structures with a thin, uniform coat of asphalt prime material.

.4 Where the asphaltic surface course is placed in 2 lifts, the surface of the first lift shall first be thoroughly cleaned of dirt or other deleterious material by sweeping with a power broom supplemented by hand brooming and scraping where necessary. A tack coat shall then be applied, where required, by means of an approved pressure distributor. No levelling course or surface course mixtures shall be placed until the tack coat is thoroughly set.

3.5 TRANSPORTATION OF MIX

.1 Transport mix to job site in vehicles cleaned of foreign material.

.2 Paint or spray truck beds with light oil, limewater, soap, or detergent solution, at least once a day or as required. Elevate truck bed and thoroughly drain. No excess solution will be permitted.

.3 Schedule delivery of material for placing in daylight unless Owner's Representative approves artificial light.

.4 Deliver material to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.

.5 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at a temperature not lower than 120°C or more than 140°C.

3.6 PLACING

.1 Spreading the Mixture:

.1 The mixture shall be laid at a temperature not lower than 120°C or more than 140°C. The atmospheric air temperature shall be not less than 5°C and rising and the road surface shall be dry.

.2 The mixture shall be spread by means of a mechanical self-propelled paver or approved mechanical spreader capable of spreading the mixture true to the line, grade and crown set by the Owner's Representative. Unless operating on fixed side forms, the paver shall employ mechanical devices such as equalizing runners, straight-edge runners, evener arms, or other compensating devices to adjust the depth and confine the edges of the mixture to true lines without the use of stationary side forms. The paver shall be capable of spreading the mixture without segregation to a minimum depth of 40 mm and to adjustable widths.

.3 The paver shall be equipped with an adjustable strike off screed of such design that drag marks will be eliminated and with built-in tamping bars for compaction during spreading. The paver shall carry an approved 3 m straight edge for checking finished surface.

.4 Immediately after any course is screeded and before compaction is started, the surface shall be checked, and any irregularities adjusted. Irregularities in alignment and grade along the outside edge shall also be corrected by the addition or removal of mixture before the edge is rolled.

.5 The Contractor shall provide a competent workman who can perform the work incidental to the correction of all pavement irregularities. Special attention shall be given by him to the straight edge checking of each course immediately following the initial rolling.

.6 Where the asphaltic surface course is to be placed in 2 lifts, the first lift shall be placed, finished, and compacted for the full width as shown on the drawings, prior to commencing on the second lift.

.7 In placing the second lift, the individual mixture spreads shall be aligned in a manner such that the longitudinal joints in each layer will not coincide.

.8 In narrow areas, deep or irregular sections, intersections, turnouts, or driveways, where it is impractical to spread with a paver, the Contractor may use machine or hand methods as directed by the Owner's Representative.

.9 Machine placed asphalt shall include asphalt placed with any mechanical equipment other than a paver.

.10 Hand placed asphalt shall include asphalt placed by hand labour without the use of any mechanical equipment other than equipment used for transporting the mix.

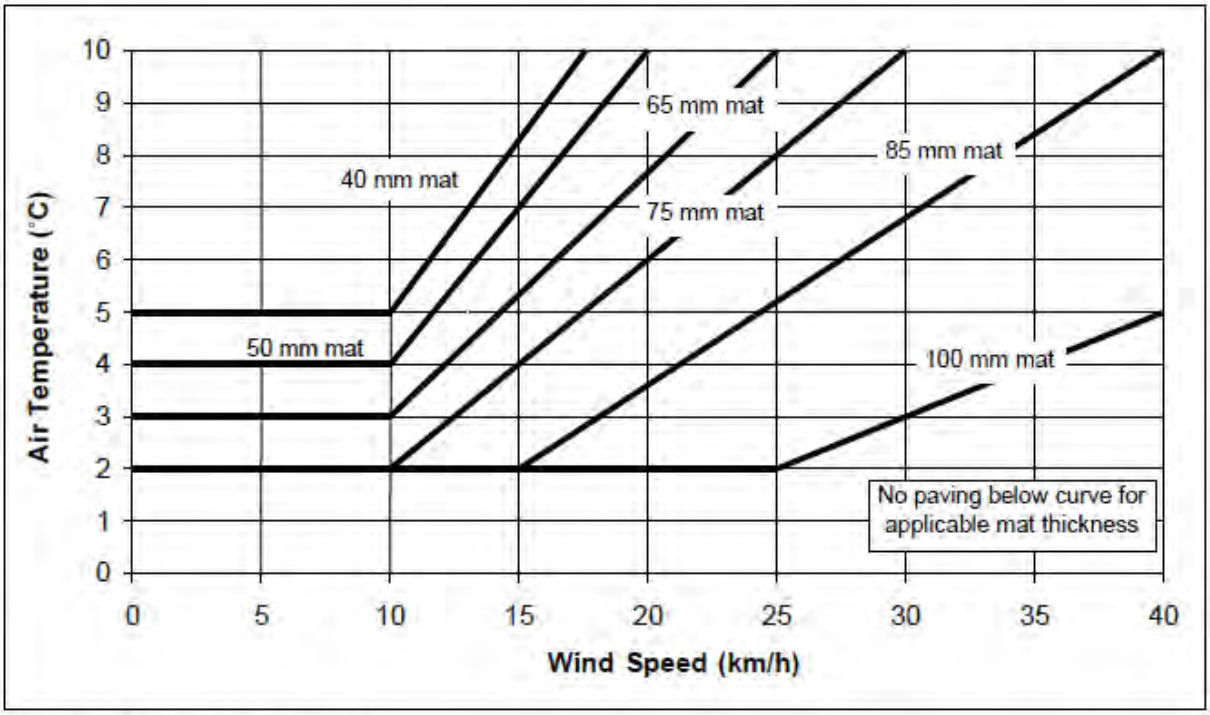
.11 Hauling over new pavement will not be permitted until the mixture has been thoroughly compacted in the manner specified and has cooled to atmospheric temperature.

.2 Cold Weather Paving

.1 No paving is permitted when rain or snow is imminent, or when the surface or base to be paved is wet, icy, snow-covered, frozen, unless waived by the Owner's Representative.

.2 No paving is permitted when the air temperature and wind speed conditions are below the applicable mat curve in the following chart, unless waived by the Owner's Representative.

.3 No paving is permitted unless the temperature of the surface on which the asphalt will be placed is above 2 degrees Celsius.



Note: City of Edmonton chart; modified.

3.7 COMPACTING

.1 Compaction

.1 After the asphaltic mixture has been spread to the uniform thickness required, it shall be compacted to a minimum Marshall Density as specified for the type of paving. The Contractor shall be responsible for the selection of the type and number of units of compaction equipment. Compaction to the specified density shall be completed before the asphaltic mixture has dropped in temperature to 65°C.

98%	All stages in staged paving for freeways, arterials, industrial/commercial roadways, and residential collector roadways.
97%	All stages in paving local residential roadways.
97%	All stages in alley paving
97%	Level Course (Min 40 mm thick); asphalt walkways

.2 The Owner's Representative reserves the right to order discontinue the use of any equipment or construction procedure which does not or will not, in his opinion, produce proper results. If asphaltic concrete surface course mix is to be placed on a previously constructed soil cement base course, vibratory compaction equipment shall be discontinued after one complete pass with the vibratory roller.

.3 The Contractor shall provide a sidewalk roller, hand tampers and other compaction equipment as required for compaction in restricted areas.

.4 The speed of compaction equipment shall not exceed 5 km/h and shall always be slow enough to avoid displacement of the hot mixture. Any displacements which occur because of reversing the direction of the roller, or from any other cause, shall at once be corrected using rakes and the addition of fresh mixture where required. Rolling shall proceed continuously until all roller marks are eliminated and no further compression is possible. To prevent adhesion of the mixture to the roller, the wheels shall be kept moistened with water, but excess water will not be permitted. Fuel oil, lubricating oil, or kerosene will not be permitted.

.5 Along curbs, manholes and other structures not accessible to the rollers, the mixture shall be compacted thoroughly by means of hot tampers. The joints between these structures and the mixture shall be effectively sealed.

3.8 JOINTS

.1 Joints

.1 Longitudinal and transverse joints shall be made in such a manner as to provide proper bonding between the two mats the full depth of the joint.

.2 Transverse joints shall be made by cutting back on the previously spread and rolled course to expose its full depth. When spreading of the course is resumed, the exposed edge of the joint shall be painted with an approved bituminous material and the freshly laid mixture shall be raked against the joint, tamped with hot tampers and rolled.

.3 The mixture shall be spread and laid so that all longitudinal joints are made while the asphalt mat which was laid first is still hot.

.4 A narrow strip along the edge of a mat which is to be joined with another asphalt mat shall be left without rolling until the adjoining mat has been placed against it. The joint which is formed shall be rolled immediately after the adjacent mat has been placed to ensure a bonding of the material while the asphalt is still hot.

.5 Care must be taken during the forming of the joints so that there will be a coincidence of surface planes devoid of ridges or depressions at the joints.

.6 Transverse joints in succeeding courses shall be offset at least 0.6 m. Longitudinal joints shall be offset at least 0.2 m.

.7 All concrete or metal surfaces such as curbs, manholes, etc., that are to come in contact with plant-mix material shall be painted with a thin coat of approved bituminous material. Where mechanical placing methods do not produce proper joints at gutters, curbs or other structures, hand methods will be required.

3.9 FINISH TOLERANCES

.1 Smoothness: maximum variation under 3 m straight edge as follows:

.1 Longitudinal in direction of travel: 3 mm.

.2 Transverse to direction of travel: 6 mm.

.2 Grade + 6 mm maximum variation from designated grade elevations.

.3 Texture: finished surface shall have a tight knit texture free of visible signs of poor workmanship such as, but not limited to:

.1 segregation,

.2 areas exhibiting excess or insufficient asphalt,

.3 improper matching of longitudinal and transverse joints,

.4 roller marks, cracking, or tearing.

.4 If surface and grade tolerances are exceeded, or if surface texture is not met, grind down and resurface defective areas as directed by the Owner's Representative.

.5 Segregation:

.1 The finished surface shall have a uniform texture and be free of segregated areas. A segregated area is defined as an area of the pavement where the texture differs visually from the texture of the surrounding pavement.

.2 All segregation shall be evaluated by the Owner's Representative to determine repair requirements.

.3 The severity of the segregation shall be rated as follows:

.1 Slight – The matrix of asphalt cement and fine aggregate is in place between the coarse aggregate particles, however there is more stone in comparison to the surrounding acceptable mix.

.2 Moderate – Significantly more stone than the surrounding mix and exhibit a lack of surrounding matrix.

.3 Severe – Appears as an area of very stony mix, stone against stone, with very little or no matrix.

.4 Centre-of-Paver Streak – Appears as a continuous or semi-continuous longitudinal "streak" typically located in the middle of the paver "mat".

.4 Segregated areas shall be repaired by the Contractor as directed by the Owner's Representative. The following methods of repair are identified:

.1 Slight – squeegee asphalt to completely fill the surface voids.

.2 Moderate – slurry seal for full mat width.

.3 Severe – removal and replacement or overlay.

.4 Centre-of-Paver Streak – only moderate and severely segregated centre-of-paver streak on the top lift of pavement will require repair.

.5 All repairs shall be regular in shape and finished using good workmanship practices to provide an appearance acceptable to the Owner's Representative.

.6 Any other methods of repair proposed by the Contractor will be subject to the approval of the Owner's Representative.

.7 Repairs shall be carried out by the Contractor at their expense.

3.10 THICKNESS TOLERANCE

.1 Representative Cores: At the Owner's Representative's request, the quality assurance laboratory will take one or more sets of cores from asphalt pavement suspected to be deficient in total thickness, each set comprising 3 cores whose average thickness represents not more than 1000 m^2 of asphalt pavement.

.2 Deficient Thickness: If average core thickness is deficient, that area of asphalt pavement will be assessed a pay factor to be applied to the pro-rated price of the top 50 mm of asphalt surface. Pay factors will be assessed as per Measurement and Payment in this Section.

.3 Excess Thickness: Asphalt pavement with excess thickness may be accepted with no extra payment if surface and grade tolerances and texture are met.

3.11 DENSITY TOLERANCE

.1 Sampling and Testing: The quality assurance laboratory will:

.1 Determine the density of laboratory compacted Marshall specimens at a minimum frequency of one Marshall density for every 1000 tonnes of hot-mix, or a day's production and/or one per street, whichever is less.

.2 Drill cores from compacted mat placed from same load of hot mix from which Marshall specimens were taken, or from suspected compacted mat, and test for density.

.2 Basis of Acceptance: Pavement compaction will be accepted on the basis of the ratio (in percent of the core density to the density of Marshall specimen. If cores were drilled from mat where no Marshall specimen was taken, acceptance will be based on the ratio of core density to the average density of all Marshall specimens to date.

.3 Representative Cores: A single core is initially taken representing the quantity of hot mix in not more than 1000 m^2 of mat, with a minimum of one core taken from a day's production. If the initial core density is below specified, that initial density is discarded, and 3 new cores will be taken from the same area minimum separation of 10m between cores. The average density of the 3 new cores represents that area.

.4 Deficient Density: If the average core density is below specified, the represented area of mat may be accepted subject to a pay factor to be applied to the price of the quantity of hot mix in that mat area. Pay factors will be assessed as per Measurement and Payment in this Section.

3.12 CLEAN UP AND TRAFFIC

.1 The entire project, including construction areas as well as Contractor's yards, shall be left in as good or better than preconstruction condition. Clean up the project site at the end of each construction day including removal of all construction refuse from boulevards, ditches, roadways, driveways, and yards to the satisfaction of the Owner's Representative.

.2 Construction inspections will take place throughout the duration of the project. Owner's Representative will take preconstruction photos as a benchmark for post construction clean-up requirements.

.3 Traffic shall not be permitted on the finished pavement until it has cooled to atmospheric temperature. The Contractor shall be responsible for traffic control during construction and shall maintain traffic to the satisfaction of the Owner's Representative.

.4 Within 24 hours following the placement of asphalt, visually inspect all manholes, catch basins, and valve boxes. Verify that structures have not been paved over, and that covers are removable and vent holes have not been sealed with asphalt. Remove all accumulated asphalt or other debris that may have fallen to the bottom of the structure to the satisfaction of the Owner's Representative. Use hydrovac or other acceptable mechanical method.

3.13 QUALITY CONTROL

.1 Quality Control

.1 The Contractor shall be responsible for quality control.

.2 Copies of results for any quality control testing carried out by the Contractor shall be forwarded directly to the Owner's Representative.

3.14 TESTING AND INSPECTION

.1 Testing and Inspection

.1 The quality assurance laboratory will undertake testing outlined in 3.10 and 3.11.

.2 The Owner's Representative will have access at any time to all parts of the paving plant for checking mix proportioning and other tests. Tests will be taken by the Owner's Representative at his discretion at no expense to the Contractor to check compliance with the specifications to determine acceptability of the end product.

.3 Copies of test results will be made available to the Contractor.

3.15 MANHOLE AND CATCHBASIN ADJUSTMENTS

.1 Prior to commencing asphalt overlay operations, the Contractor shall locate all manholes and catchbasins, which will interfere with the operation. Prior to placing the surface course, the Contractor shall raise the manholes to the design finished pavement surface elevation. The manhole frames and covers shall be set to conform to the established cross slopes and grades of the pavement surfaces.

.2 Adjustments to the manholes shall be made using the types of materials and workmanship used in constructing the original structure.

.3 Refer to Section 2 02 22 – Adjustment of Manholes, Catch Basins, Hydrants, and Water Valves for manhole and catch basin adjustments.

4 Measurement and Payment

.1 The quantity of hot mix asphalt concrete paving for which payment will be made shall be the actual number of square metres (m^2) of accepted asphalt paving measured in place for the depths shown in the Bid Form. It shall be paid for at the contract unit price bid per square metre based on the Owner's Representative's field area measurements and specified compacted thickness.

This price and payment shall be full compensation for preparation of mix design and job mix formula, for supply, crushing and hauling aggregates, for blending of aggregates, for supplying and mixing asphalt binder with the aggregate in amounts called for in the mix design, for laying and compacting the asphaltic mixture, for applying tack and prime coat, and for all equipment, material, labour, tools necessary to complete the item in accordance with these specifications.

.2 Payment reductions shall apply to those areas found to be deficient in thickness and density unless other corrective actions taken by the Contractor are approved by the Owner's Representative. For Development projects, asphalt payment penalties shall be withheld from the securities collected for the asphalt paving work. For Capital projects, asphalt payment penalties shall be deducted from the associated line item for asphalt paving.

.1 Payment reductions for deficient thickness shall be applied in accordance with the "Asphalt Thickness Penalty" table and the following conditions:

.2 There will be no payment reduction for areas deficient in thickness by 6 mm or less.

.3 No payment shall be made for areas of pavement found deficient in thickness by over 15 mm.

.4 Areas of pavement found by testing to be deficient in thickness by 7 mm or more, but less than 15 mm shall be paid for at an adjusted unit price.

.3 The Contractor shall arrange and pay for testing involved in determining the extent of pavement having insufficient depth.

.4 Payment reductions for deficient densities shall be applied in accordance with the "Asphalt Density Penalty" table. The Contractor shall arrange and pay for testing involved in determining the extent of pavement having deficient densities.

.5 The price and payment shall also include full compensation for clean-up of all aggregate/asphalt materials that may fall off delivery trucks/equipment along public road haul routes and, the removal of any tack coat that has been tracked on to concrete structures or roadway pavement markings. All haul routes shall be inspected prior to commencement of work and again following completion of work to determine clean-up requirements. Any clean-up work not performed in a timely manner will be completed by the Regional Municipality of Wood Buffalo with all related costs deducted from final payments.

Asphalt Thickness Penalty	
Thickness Deficiency (mm)	Payment Reduction (%)
6.0	0.0
7.0	3.0
8.0	6.3
9.0	10.0
10.0	14.5
11.0	19.5
12.0	25.0
13.0	32.0
14.0	40.0
15.0	50.0
Over 15.0	Grind and resurface

Asphalt Density Penalty			
98% Minimum Density Requirement		97% Minimum Density Requirement	
Density (%)	Payment Reduction	Density (%)	Payment Reduction
98.0 and greater	0.0	97.0 and greater	0.0
97.9	0.1	96.9	0.1
97.8	0.2	96.8	0.3
97.7	0.4	96.7	0.6
97.6	0.6	96.6	0.9
97.5	0.9	96.5	1.3
97.4	1.3	96.4	1.8
97.3	1.7	96.3	2.3
97.2	2.2	96.2	2.9
97.1	2.8	96.1	3.7
97.0	3.5	96.0	4.5
96.9	4.2	95.9	5.4
96.8	5.0	95.8	6.4
96.7	5.8	95.7	7.5
96.6	6.7	95.6	8.7
96.5	7.7	95.5	10.1
96.4	8.9	95.4	11.6
96.3	10.2	95.3	13.3
96.2	11.5	95.2	15.2
96.1	12.9	95.1	17.3
96.0	14.5	95.0	19.7
95.9	16.7	94.9	22.4
95.8	18.0	94.8	25.7
95.7	20.0	94.7	29.4
95.6	22.3	94.6	34.0
95.5	24.6	94.5	40.0
95.4	27.0	Under 94.5	Remove and Replace
95.3	29.7		
95.2	32.8		
95.1	36.3		
95.0	40.0		
Under 95.0	Remove and Replace		

Actual Density = average % of Marshall Densities for the three (3) representative cores.

Pay Factor = % of unit price.

END OF SECTION

1 General

The supply and application of liquid asphalt to seal the surface of the granular base courses and to provide a bond with subsequent paving courses.

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D5, Standard Test Method for Penetration of Bituminous Materials

.2 ASTM D88, Standard Test Method for Saybolt Viscosity.

.3 ASTM D140/D140M, Standard Practice for Sampling Asphalt Materials.

.4 ASTM D244, Standard Test Methods and Practices for Emulsified Asphalts.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-16.1-M89, Cutback Asphalts for Road Purposes.

.2 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.2 SAMPLES

.1 Submit manufacturer's test data and certification that asphalt prime material meets requirements of this section in accordance with Section 1 04 00 - Submittal Procedures.

2 Products

2.1 MATERIAL

.1 The prime coat shall be a liquid asphalt Type MS-1 placed at an application rate of 1.5 L/m^2 (+/- 0.5) with a concentration of 100%.

2.2 MATERIAL SPECIFICATIONS

Viscosity at 25°C	Min 20, Max 100
Residue by Distillation, (% by mass)	Min 55
Settlement in 5 days (% difference by mass)	Max 5
Storage Stability Test 24hr (% by mass)	Max 1.5
Retained on No 1000 Sieve (% by mass)	Max 0.10
Cement Mixing Test, (% by mass)	Max 2.0
Penetration at 25°C , 100g, 5s dmm	Min 100, Max 200
Ductility at 25°C and 5cm/min, cm	-
Solubility in Trichloroethylene (% by mass)	-
Delivery Temperature °C	Min 40 Max 70

.1 Testing to ASTM, D88, D244, and D5.

3 Execution

3.1 EQUIPMENT

.1 Pressure distributor to be:

.1 Designed, equipped, maintained, and operated so that asphalt material can be:

.1 Maintained at even temperature.

.2 Applied uniformly on variable widths of surface up to 4 m.

.3 Applied at controlled rates of 1.5 L/m^2 with uniform pressure.

.4 Distributed in uniform spray without atomization at temperature specified.

.2 Equipped with meter registering metres of travel per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.

.4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.5 Equipped with accurate volume measuring device or calibrated tank.

.6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

.7 Equipped with nozzle spray bar, with operational height adjustment.

.8 Cleaned if previously used with incompatible asphalt material.

3.2 APPLICATION

.1 Obtain Owner Representative’s approval of granular base surface before applying asphalt prime.

.2 Protect adjoining curb, gutter, walk, slabs, and any other surface not intended for coating. Remove any splatter on those surfaces.

.3 Do not apply liquid asphalt when the weather is foggy, rainy, windy, or when the air temperature is below 2°C

.4 Spray liquid asphalt to a uniform coat. Do not spray excessively to create ponding. Hand spray areas missed by or inaccessible to the distributor.

.5 Do not allow traffic on prime coat within 6 hours of application or until prime coat has cured.

.6 Permit prime to cure before placing asphalt paving.

3.3 USE OF SAND BLOTTER

.1 If asphalt prime fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.

.2 Allow sufficient time for excess prime to be absorbed as directed by Owner's Representative.

.3 Apply second application of sand blotter as required.

.4 Sweep and remove excess blotter material and dispose in an environmentally approved manner.

3.4 QUALITY ASSURANCE

.1 A qualified testing laboratory shall be engaged and paid for by the contractor for all liquid asphalt testing.

.2 Owner's Representative may request samples of liquid asphalt for testing by a material testing lab.

4 Measurement and Payment

.1 There will be no extra payment for prime coat. Include costs in related items as per Section 3 08 00 Hot Mix Asphalt Concrete Paving.

END OF SECTION

1 General

Section includes specification for the application of liquid asphalt to provide a bond between and existing asphalt surface and the overlaying asphalt surface.

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D5, Standard Test Method for Penetration of Bituminous Materials.

.2 ASTM D88, Standard Test Method for Saybolt Viscosity.

.3 ASTM D113, Standard Test Method for Ductility of Bituminous Materials.

.4 ASTM D140/D140M, Standard Practice for Sampling Asphalt Materials.

.5 ASTM D244, Standard Test Methods and Practices for Emulsified Asphalts

.6 ASTM D2042, Standard Test Method for Solubility of Asphalt Materials in Trichloroethylene.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-16.1-M89, Cutback Asphalts for Road Purposes.

.2 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes

1.2 SAMPLES

.1 Submit manufacturer's test data and certification that asphalt prime material meets requirements of this section, and in accordance with Section 1 04 00 - Submittal Procedures.

2 Products

2.1 MATERIALS

.1 Asphalt Tack coat shall be a liquid asphalt Type SS-1, MS-1 placed at an application rate of 0.5 L/m^2 (+/- 0.2) with a concentration of 100%.

2.2 MATERIAL SPECIFICATIONS

Asphalt Grade Requirements	SS-1 Min	Max	MS-1 Min	Max
Viscosity at 25°C	20	60	20	100
Residue by Distillation, (% by mass)	55	-	55	-
Settlement in 5 days (% difference by mass)	-	5	-	5
Storage Stability Test 24hr (% by mass)	-	1	-	1.5
Retained on No 1000 Sieve (% by mass)	-	0.10	-	0.10
Cement Mixing Test, (% by mass)	-	2.0	-	2.0
Penetration at 25°C , 100g, 5s dmm	100	200	100	200
Ductility at 25°C and 5cm/min, cm	60	-	40	-
Solubility in Trichloroethylene (% by mass)	97.5	-	97.5	-
Delivery Temperature °C	40	70	40	70

.1 Testing to ASTM, D88, D244, and D5, D113, D2042.

3 Execution

3.1 EQUIPMENT

.1 Pressure distributor to be:

.1 Designed, equipped, maintained and operated so that asphalt material can be:

.1 Maintained at even temperature.

.2 Applied uniformly on variable widths of surface up to 5 m.

.3 Applied at readily determined and controlled rates of 0.50 L/m^2 with uniform pressure.

.4 Distributed in uniform spray without atomization at temperature required.

.2 Equipped with meter, registering metres of travel per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.

.4 Equipped with an easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.5 Equipped with accurate volume measuring device or calibrated tank.

.6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

.7 Equipped with nozzle spray bar, with operational height adjustment.

.8 Cleaned to be free from previously used incompatible asphalt material..

3.2 APPLICATION

.1 Apply asphalt tack coat only on clean and dry surface. Obtain Owner Representative's approval of surface before applying asphalt tack coat.

.2 Dilute asphalt emulsion with water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Owner's Representative.

.3 Apply asphalt tack coat evenly to pavement surface at rate as indicated in manufacturer's specifications.

.4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

.5 Do not apply asphalt tack coat when air temperature is less than 2ºC or when rain is forecast within two (2) hours of application.

.6 Apply asphalt tack coat only to surfaces that are expected to be overlayed on same day.

.7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Owner's Representative.

.8 Where traffic is to be maintained, treat no more than one half of width of surface in one application.

.9 Keep traffic off tacked areas until asphalt tack coat has set.

.10 Re-tack contaminated or disturbed areas as directed by Owner's Representative.

.11 Permit asphalt tack coat to set before placing asphalt pavement.

3.3 QUALITY ASSURANCE

.1 Upon request by Owner's Representative, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of these Construction Specifications.

4 Measurement and Payment

.1 There will be no extra payment for tack coat. Include costs in related items as per Section 3 08 00 Hot Mix Asphalt Concrete Paving.

END OF SECTION

1 General

This section specifies the requirements for producing and placing chip seal aggregate wearing course, including supply of aggregates and bituminous binder.

1.1 SAMPLES

.1 Submit manufacturer's test data and certification that asphalt binder meets requirements of this section, and in accordance with Section 1 04 00 - Submittal Procedures.

.2 Submit, 2 weeks in advance, methods for rerouting traffic around Chip Sealing operations for review by Owner’s Representative.

2 Products

2.1 MATERIAL

.1 Asphalt Binder to be emulsified asphalt cement with properties as shown in Table 7 and Table 8 of the Alberta Transportation Standard Specifications for Highway Construction Latest Edition.

.1 Anionic: RS-1, RS-2, MS-1,

.2 Cationic: RS-1K, RS-2K, CRS-2

.2 Aggregate:

.1 To be product aggregate in accordance with Section 3 04 00 Aggregate Materials.

.2 Aggregate shall be washed crushed gravel, Des 3 CL 12.5W with gradations conforming to the following:

Percent Passing Metric Sieve	12,500	100
	10,000	55-75
	8,000	
	5,000	0-15
	1,250	0-3
	630	
	315	
	160	
	80	0-.03
% Fracture by Weight (2 Faces)	All +5000	60+
Plasticity Index (PI)		NA
L.A. Abrasion Loss Percent Max	35	35
Flakiness Index		Max 15

3 Execution

3.1 EQUIPMENT

.1 The contractor shall provide a self powered asphalt distributor, self propelled aggregate spreader, self propelled pneumatic rollers, and power sweepers suitable for completing the work.

3.2 PREPARATION

.1 Notice to Owner's Representative shall be given 48 hours in advance of chip sealing operations.

.2 Provide signage in accordance to approved traffic accommodation plan.

.3 Sweep pavement surface, patch and correct depressions and other irregularities to the approval of the Owner's Representative.

.4 The work shall be carried out when ambient temperatures are 5°C or greater. Chip Sealing operations to halt if inclement weather is imminent.

.5 Apply asphalt binder as indicated on the drawings or as instructed by Owner's Representative.

.6 Prevent asphalt binder from entering storm sewers.

.7 Distribute material uniformly. Do not broadcast material.

.8 Traffic shall not be permitted to travel on binder nor freshly chip sealed surface until chip sealing operation is complete and sweeping of loose gravel has been completed.

3.3 CLEANING AND MAINTENANCE

.1 Sweep the application areas to remove any loose chips after rolling and initial set of the binder.

.2 Continue to sweep application chip seal areas and areas adjacent to for a period of up to two weeks or as directed by the Owner's Representative.

.3 Prevent sweepings from entering storm sewers.

.4 Sweepings to be disposed per environmental regulations at an approved site.

3.4 PAVEMENT MARKINGS

.1 Place temporary reflectorized centerline and lane lines as required until permanent pavement markings are installed.

.2 Apply permanent pavement markings in accordance with Section 3 10 00 – Pavement Marking - General.

.3 Pavement markings removed or damaged during sweeping process to be replaced.

.4 Permanent pavement markings to be installed maximum 3 days after chip seal operation is complete.

3.5 QUALITY ASSURANCE

.1 Materials shall meet all specifications.

.2 A minimum of 99% chip seal coverage shall be obtained with no single bare area greater than $0.01m^2$ in any one square meter.

.3 There shall be no streaking or ravelling.

.4 The finished surface shall be uniform and of even texture.

.5 No over rich or bleeding areas shall be evident.

.6 All pavement markings to be in good condition.

3.6 MEASUREMENT AND PAYMENT

.1 Chip sealing shall be measured and paid for by the square meter (m^2) of completed surface area.

.2 The unit price shall include all materials, labour, equipment, and incidentals required to complete the work.

END OF SECTION

1 General

.1 Micro-Surfacing is a slurry seal type of application which is placed on both travel lanes within the limits shown on the drawings. The micro-surfacing treatment is intended to fill the existing wheel path ruts as well as providing a durable, skid resistant surface. The Micro-Surfacing mixture shall consist of cationic polymer modified asphalt, mineral aggregate, mineral filler, field control additive and water.

.2 This Specification describes the material supply, design, equipment, construction, and application procedures associated with the rut filling and/or surfacing of an existing paved surface with micro-surfacing material. Material requirements and test procedures contained in this Specification are based upon the publication prepared by the International Slurry Seal Surfacing Association (ISSA) titled "Recommended Performance Guidelines for Micro-Surfacing A143," Latest Edition.

1.2 REFERENCES

.1 International Slurry Seal Surfacing Association (ISSA)

1.3 TRAFFIC CONTROL

.1 Traffic control and temporary construction signage to be provided in accordance with Sections 1 05 00 - Traffic Control.

2 Products

2.1 MIX DESIGN

.1 The Contractor shall supply the mix design, and all components of the mix. The Contractor shall submit a mix design, signed, and stamped by a Professional Engineer, to the Owner's Representative a minimum of 5 working days prior to the placement of any micro-surfacing material. The mix design shall be prepared by a testing laboratory that has prior experience in the design of micro-surfacing mixes using ISSA test methods and design procedures. No micro-surfacing material shall be placed prior to the Owner's Representative reviewing and accepting the submitted mix design.

.2 Compatibility of the aggregate, polymer-modified emulsion, mineral filler and other additives shall be verified by the mix design. All component materials used in the mix design shall be representative of the materials proposed by the Contractor for use on this project. The mix design shall list the characteristics and proportions of all materials used in the micro-surfacing formulation.

.3 The micro-surfacing material shall meet the following mix design requirements:

ISSA TEST NO.	DESCRIPTION	SPECIFICATION
ISSA TB-139	Wet Cohesion @30 minutes minimum (Set) @60 minutes minimum (Traffic)	 12 kg-cm minimum 20 kg-cm Minimum or Near Spin
ISSA TB-109	Excess Asphalt by LWT Sand Adhesion	538 g/m^2
ISSA TB-114	Wet Stripping	Pass (90% minimum)
ISSA TB-100	Wet-Track Abrasion Loss One-hour Soak Six-day Soak	 538 g/m^2 maximum 807 g/m^2 maximum
ISSA TB-147	Lateral Displacement Specific Gravity after 1,000 cycles of 11.34 kg	5% maximum 2.10 maximum
ISSA TB-144	Classification Compatibility	11 grade points minimum (AAA, BAA)
ISSA TB-113	Mix Time @ 25°C	Controllable to 120 s minimum

.4 The mix design proportions shall be within the following limits.

.5 Residual asphalt: 6 to 11.5% by dry weight of aggregate.

.6 Mineral filler: 0.0 to 3.0% by dry weight of aggregate.

.7 Polymer Content: Minimum of 3% solids based on bitumen weight content.

.8 The micro-surfacing material shall be designed to accommodate traffic without damage within one hour of placement.

2.2 ASPHALT MATERIALS

.1 The emulsified asphalt shall be a quick-traffic polymer modified asphalt emulsion conforming to the requirements of AASHTO M208 for CSS-1h with the following changes.

.1 The cement mixing test shall be waived for this emulsion.

.2 The Residue after Distillation shall be a minimum of 62%.

.2 The Residue after Distillation shall also meet the following requirements:

TEST METHOD	TESTS ON RESIDUE	SPECIFICATION
AASHTO T53	Softening Point	57°C minimum
AASHTO T49	Penetration at 25°C	40 -90 dmm *
ASTM D2171	Kinematic Viscosity @ 135°C	50 cSt/sec minimum
ASTM D6930	Settlement and Storage Stability	1% maximum

*Subject to project specifics

.3 The polymer material shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process.

.4 The addition rate of polymer modifier shall be a minimum of 3% polymer solids by mass of asphalt residue.

.5 Each load of emulsified asphalt shall be accompanied with a Certificate of Analysis/Compliance indicating that all asphalt requirements are met.

2.3 AGGREGATE

.1 The ISSA Type II aggregate gradation shall be used. All aggregate shall be 100% manufactured material that meets the following Specifications and is evaluated as being fully compatible with the specified emulsion.

.2 The aggregate gradation, including mineral filler, shall be within the following limits:

Sieve Size (μm)	Percent Passing (Type I)	Percent Passing (Type II)	Stockpile Tolerance
10,000	100	100	-
5,000	100	90 - 100	+/- 5%
2,500	90 - 100	65 -90	+/- 5%
1,250	65 - 90	45 -70	+/- 5%
630	40 - 65	30 -50	+/- 5%
315	25 - 42	18 – 30	+/- 4%
160	15 - 30	10 - 21	+/- 3%
80	10 - 20	5 -15	+/- 2%

.3 Screening, at the discretion of the Owner's Representative, may be required, by the contractor, at the stockpile prior to delivery to the paving machine if there are any problems created by having oversize or excessive fines in the mix.

2.4 WATER

.1 The Contractor shall arrange for and supply the water used for the mixing of the micro-surfacing material and pre-wetting of the existing pavement. The water shall be potable and free of harmful soluble salts.

2.5 MINERAL FILLER

.1 The Contractor shall supply the mineral filler which shall be introduced into the mineral aggregate. Mineral filler may be any recognized brand of non air-entrained Portland cement, hydrated lime or any other approved mineral filler that is free of lumps. The amount and type of mineral filler needed will be determined by the laboratory mix design and will be considered as part of the material gradation requirement. An increase or decrease of less than 1% may be permitted in the field for improving the mix consistency or set times.

2.6 FIELD CONTROL ADDITIVE

.1 The Contractor shall supply the specified field control additive and apply it as required to maintain quick-set characteristics of the mix.

2.7 MICRO-SURFACING MIX STABILITY AND FIELD CONTROL ADDITIVE

.1 The micro-surfacing mixture shall be homogeneous during and following mixing and spreading. The micro-surfacing mix shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. To maintain mixture stability the liquid field control additive may be introduced to provide effective control of the required quick-set properties.

3 Execution

3.1 EQUIPMENT

.1 General

.1 The Contractor shall provide all equipment, tools, machines, and incidentals necessary to complete the Work. All equipment shall be always maintained in a clean and satisfactory working condition to ensure a high-quality product.

.2 The Contractor shall provide a self-propelled micro-surfacing mixing machine specifically designed and manufactured to lay micro-surfacing. The equipment shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, field control additive, and water to a revolving multi-blade twin shafted mixer and discharge the mixed product on a continuous flow basis. The machine shall be equipped to allow the operator to have full control of the forward and reverse speed during application of the micro-surfacing material.

.2 Proportioning Device

.1 The Contractor shall provide proportioning devices that are properly marked for the individual volume or weight proportioning of each raw material to be added to the mix. These proportioning devices can be revolution counters or similar devices and are to be used in the material calibration for determining the mix design dial and gate settings and calculating the materials output at any time.

.3 Spreading Equipment

.1 The mechanical spreader box attached to the paver shall be equipped with rotating paddle shafts to agitate and spread the material throughout the box and be capable of uniformly spreading the micro-surfacing mixture. A front seal shall be provided to ensure no loss of the mixture at the road contact point. The rear seal shall act as the final strike off and shall be adjustable. The spreading equipment shall be capable of spreading the mixture to fill cracks and minor surface irregularities and leave a uniform friction resistant application of material on the surface. The spreader box and rear strike off shall be so designed and operated that a free flow of material to the rear strike off is achieved.

.2 The spreader box shall have suitable means provided to side shift the box to compensate for any change in longitudinal alignment. All excess material shall be removed from the job site prior to opening the road.

.4 Auxiliary Equipment

.1 Surface cleaning equipment, hand tools, and any support equipment shall be provided by the Contractor as necessary to perform the work.

.5 Sampling Requirements

.1 The Contractor shall arrange to have suitable sampling facilities for the Owner's Representative to obtain representative field samples of the micro-surfacing mixture and each of the component materials.

.6 Machine Calibration

.1 Each mixing unit to be used in performance of the work shall be calibrated in the presence of the Owner's Representative prior to construction. The calibration shall be documented and shall include the individual calibration of aggregate, mineral filler, and emulsified asphalt at various settings, which can be related to the machine proportioning devices to verify the application rate and mix design compliance.

3.2 SEASONAL AND WEATHER LIMITATIONS

.1 The placement of micro-surfacing shall be limited to the period from June 1 to September 15. Micro-surfacing shall not be placed when, in the opinion of the Owner's Representative, damage to the finished product may occur for any reason.

.2 The micro-surfacing shall be placed only when the atmospheric temperature is at least 10°C and rising and the weather is free of fog or precipitation and there is no forecast of temperatures below 0°C within 24 hours from the time of application.

3.3 SURFACE PREPARATION

.1 The area to be surfaced shall be thoroughly cleaned of loose aggregate and soil, particularly soil that is bound to the surface.

.2 Thermoplastic markings, appurtenances, storms sewer to be covered.

3.4 APPLICATION

.1 The surface shall be pre-wetted by fogging, with water, ahead of the spreader box when required by local conditions or sprayed with tack coat if required. The rate of application of the fog spray shall be adjusted during the day to suit temperatures, surface texture, humidity, and dryness of the pavement.

.2 The micro-surfacing mixture shall be of the desired consistency when exiting the mixer and no additional materials shall be added. A sufficient amount of material shall

be carried in all parts of the spreader box at all times so that complete coverage is obtained. Overloading of the spreader box shall be avoided. No lumping, balling, or unmixed aggregate will be permitted. The material shall not have segregation of the emulsion and aggregate fines from the coarser aggregate.

.3 No streaks, such as those caused by oversize aggregate shall be left in the finished surface. If excessive streaking or drag develops, the operation will be stopped until the Contractor proves to the Owner's Representative that the situation has been corrected.

.4 The suggested application rate (based on dry aggregate) for the surface pass shall be 12 - 16 kg/m2, or as directed by the Owner's Representative, and shall use exclusively Type II aggregate as outlined in Clause 2.3.

.5 No excessive build-up, uncovered areas, or unsightly appearances will be permitted.

3.5 HAND WORK

.1 Small areas of non-uniform application shall be spot repaired using hand squeegees to provide completed and uniform coverage. Care shall be exercised to prevent an unsightly appearance from the handwork. The same type of finish as applied by the spreader box will be required.

3.6 JOINTS

.1 No excess build-up, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The Contractor shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints through the project. When possible, longitudinal joints shall be placed on lane lines. Partial width passes will only be used when necessary and shall not be the last pass of any paved area. A maximum of 3.0 inches (76.2 mm) shall be allowed for overlap of longitudinal joints.

.2 Also, the joint shall have no more than a 0.25-inch (6.4 mm) difference in elevation when measured by placing a 10 ft (3 m) straight edge over the joint and measuring the elevation difference.

3.7 MIXTURE

.1 The micro-surfacing mixture shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess liquids that create segregation of the aggregate. Spraying of additional water into the spreader box will not be permitted.

3.8 LINES

.1 Care shall be taken to ensure straight lines along curbs and shoulders. No runoff on these areas will be permitted. Lines at intersections will be kept straight to provide a good appearance.

3.9 CLEAN-UP

.1 All areas, such as manways, gutters, and intersections, shall have the Micro-Surfacing mix removed. The contractor shall remove any debris associated with the performance of the work daily.

.2 All utility access areas, gutters, and intersection shall have the micro-surfacing removed as specified by the Owner's Representative. The Contractor shall remove any debris associated with the performance of the work daily.

3.10 TRAFFIC READINESS

.1 The modified emulsified asphalt will be formulated so that the material will cure sufficiently so that rolling traffic can be allowed on the surface within one hour of placing with no damage to the surface. Areas with rut fills deeper than 25 mm and fills in areas where hard, sharp turning or braking occurs may require up to one additional hour of cure time as directed by the Owner's Representative.

.2 The Contractor shall ensure that all lanes of travel remain open for traffic every night.

3.11 ACCEPTANCE AND WARRANTY

.1 Requirements for the acceptance of the completed micro-surfacing include the following:

.1 Materials shall meet all specified requirements.

.2 The finished micro-surfacing shall have a uniform texture free from excessive scratch marks, tears, or other surface irregularities. Tear marks in any 12 square metre area per lane are considered excessive if there are:

.1 Four or more marks ≥12 mm wide and ≥100 mm long.

.2 Any marks ≥ 25 mm wide and ≥25 mm long.

.3 There shall be no longitudinal ripples, raking, wash-boarding, chatter, or other irregularities that will affect the ride quality.

.4 The edges of the micro-surfacing shall be finished uniformly, with a neat appearance along the roadway centreline, lane lines, shoulder, pavement edge and curb lines.

.5 The finished surface shall have a uniform, even texture.

.6 No over-rich or bleeding areas shall be evident.

.7 No loose chips shall be evident.

.8 All existing pavement markings have been preserved or replaced in accordance with Sections 3 10 10 - Painted Lines and Markings and 3 10 20 – Thermoplastic Pavement Markings.

.9 Work that does not meet the foregoing requirements shall be repaired or reconstructed to the satisfaction of the Owner's Representative.

4 Measurement and Payment

.1 Micro-Surfacing will be measured in square metres (m^2). This payment will be full compensation for designing the mix, surface preparation, processing, hauling, and placing the mixture, traffic control and quality control, supplying and processing of all material including but not limited to, aggregate, emulsified asphalt binder, water, mineral filler, and field additives.

.2 Payment for preparing trial batches of micro-surfacing for evaluating the proper proportions of the various ingredients is considered incidental and shall be included in the unit price bid for "Micro-Surfacing". If the trial batch is acceptable as applied, it will be measured and paid for at the applicable unit price. If it is unacceptable and covered by a second application, no payment will be made for the trial batch applied.

.3 If a second layer of micro-surfacing is required because of failure of the first layer, no payment will be made for the first layer.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM D244, Standard Test Methods for Emulsified Asphalt.

.2 ASTM D6690, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

.3 ASTM D7116, Standard Specification for Joint Sealants, Hot Applied, Jet-Fuel-Resistant Types, for Portland Cement Concrete Pavements.

1.2 ACTION AND SUBMITTALS

.1 Submit in accordance with Section 1 04 00 – Submittal Procedures

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pavement sealants and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Samples:

.1 Submit one 4 L container of sealant proposed for use at least 2 weeks prior to beginning Work.

.3 Tests and Evaluation Reports:

.1 Submit manufacturer's test data and certification that sealant materials meet requirements of this Section 2 weeks prior to beginning Work:

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

2 Products

2.1 MATERIALS

.1 Cold applied sealant: rubberized asphalt emulsion.

.1 To consist of suitable penetration grade asphalts, rubber latex, emulsifiers, stabilizers, and suitable modifiers, uniformly dispersed in water to form homogeneous stable emulsion.

.2 Uniformity: emulsion when left standing undisturbed for minimum 24 hours after delivery to show no separation of water, no coagulation, and no separation of base solids.

.3 Viscosity: emulsion to have Saybolt Furol viscosity of 20 to 100 seconds at 25 degrees C when tested to ASTM D244.

.4 Solids content: residue of solids not less than 59% when tested to ASTM D244, procedure A.

.5 Ash: mineral residue after ignition not to exceed 2.0%.

.6 Pooling loss at 25 degrees C: percent of emulsion which will flow out from channel 12 x 12 x 450 mm in 15 minutes must not exceed 30%.

.7 Tack-free time: 1.6 mm thick film of material to become tack-free in less than 6 hours.

.8 Resistance to water immersion: specimens of sealant 6 mm thick after curing for 72 hours, when immersed in water for 24 hours, does not re-emulsify or impart any cloudiness to water after lightly rubbing its specimen surface at end of immersion period. Specimens to remain firm during immersion period and show no blistering, significant swelling or other evidence which would reduce serviceability of material.

.9 Rate of curing: specimen of sealant 6 mm thick to lose at least 65% of water content for 24 hours curing and 85% of water content during 6 days of curing at 25 degrees C (plus or minus 1 degree) and 50% relative humidity.

.10 Flow at 50 degrees C: specimens of sealant cured on asbestos-cement panels to withstand temperature of 50 degrees C for 2.5 hours without exceeding flow of 40 mm.

.11 Low temperature flexibility: specimens of sealant cured on absorbent paper not to crack or break at minus 5 degrees C when bent 180 degrees around 12 mm diameter mandrel in 30 seconds.

.12 Elastic recovery: cured specimen stretched to eight times its original length to recover at least 40% of amount stretched in 15 minutes.

.13 Reseal-ability by flame: standard joint cut open to reseal in 40 seconds without charring or igniting when tested with propane flame.

.14 Sealing compound on delivery to have smooth uniform consistency with no evidence of coagulation or separation.

.15 Deliver in non-metallic or polyethylene lined metal drums.

.2 Hot poured sealant: to ASTM D6690.

2.2 EQUIPMENT

.1 Heating equipment for melting sealant:

.1 Insulated double shell, oil jacketed kettle.

.2 Motor driven agitator.

.3 Totally automatic temperature control system controlling both heat transfer oil temperature and sealing compound temperature.

.2 Pressure applicator capable of applying sealant at 100 kPa by means of hose and wand fitted with size of tip suitable for cracks.

.1 Capable of maintaining temperature of sealant as per manufacturer's recommendation during application.

.3 Mechanical rotary routers specifically designed for following random irregular cracks without tearing, chipping, or spalling edge of cracks and capable of producing clean, vertical side walls. Open "V" type grooves not permitted.

.4 Mixer: in accordance with manufacturer's recommendations.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pavement sealant application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Owner’s Representative.

.2 Inform Owner’s Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Use joint plows or high-pressure water to remove old sealant material from designated joints or cracks.

.2 Rout cracks to width approved by Owner’s Representative.

.3 Centre of rout to deviate not more than plus or minus 8 mm from centreline of crack.

.4 Dispose of material removed from cracks as directed by Owner’s Representative.

.5 Clean and dry routed cracks using lance with oil-free hot compressed air, applied at minimum pressure of 600 kPa.

.6 Where crack extends into base or subgrade, fill crack with sand-asphalt emulsion mixture.

.7 Obtain Owner's Representative's approval of preparation of cracks before application of sealant.

3.3 APPLICATION OF SEALANT

.1 Do not use sealant material that has been frozen.

.2 Ensure cracks are clean and dry immediately before applying sealant.

.3 Heat joint sealant slowly to application temperature in accordance with manufacturer's recommendations.

.4 Mix two-component sealant in accordance with manufacturer's recommendations.

.5 Fill crack with sealant immediately after cleaning. Maintain tip of cone or wand close to bottom of routed groove during filling.

.6 Fill cracks only when air temperature is above 10 degrees C, daily low temperature does not fall below 5 degrees C, and no rain is forecast.

.7 Pour sealant in crack so that cooled sealant fills crack from bottom up to level 3mm to 5mm below pavement surface.

.8 Sprinkle sealed cracks with Portland cement before opening pavement to traffic.

4 Measurement and Payment

4.1 CRACK ROUTING AND SEALING

.1 Crack routing and sealing shall be measured in lineal meters.

.2 The unit price for crack routing and sealing shall include full compensation for the labour, equipment, and materials to complete the work.

4.2 CRACK REPAIR – SPRAY PATCH

.1 Crack repair - spray patch shall be measured in lineal meters.

.2 The unit price will include full compensation for cleaning the cracks, disposing of debris, tacking, supplying the crushed aggregate and asphalt binder, producing, hauling, placing, and compacting the mix and all labour, materials, equipment, tools, and incidentals necessary to complete the work to the satisfaction of the Engineer.

END OF SECTION

1 General

1.1 NOT USED

2 Products

2.1 PAVEMENT MARKINGS

.1 Pavement marking materials for Painted Traffic Lines and Markings shall conform to Section 3 10 10 – Painted Traffic Lines and Markings.

.2 Pavement marking materials for Thermoplastic Pavement Markings shall conform to Section 3 10 20 – Thermoplastic Pavement Markings.

.3 Pavement marking materials for Cold Plastic Pavement Markings shall conform to Section 3 10 30 – Cold Plastic Pavement Markings.

3 Execution

3.1 DRAWING CONFIRMATION

.1 Arrange a meeting with the Municipality's Traffic Engineer or designate to review the pavement marking drawings prior to the commencement of pre-marking.

3.2 GENERAL

.1 Dimensions and colours of lines and markings shall be in accordance with Standard Details 4-700, 4-701, 4-702, 4-703, and 4-705.

.2 Lines shall be applied as solid, dashed, or dotted stripes, either singularly or in combination, as shown on the Drawings.

.3 The Contractor shall use an accurate dashing mechanism, which is capable of being easily adjusted to retrace existing dashed markings or to apply new materials at the correct spacing.

.4 New dashed lines that are to be applied over plainly visible existing dashed lines shall begin within 150 mm of the beginning of the existing dash, unless otherwise directed by the Owner's Representative.

.5 Lines and Symbols shall be sharp, well defined, and uniformly reflective to provide proper visibility.

.6 Methods and equipment used for pavement preparation, marking, and marking removal shall be subject to the approval of the Owner's Representative.

.7 The Contractor shall furnish to the Owner's Representative copies of current manufacturer's instructions and recommendations for application of any marking material, including primer, activator, catalyst and/or adhesive, called for in the plans.

.8 Other construction work such as shoulder paving, seeding and/or mulching shall be scheduled and performed in a manner to avoid damage to applied pavement marking.

3.3 SITE PREPARATION

.1 Provide adequate warning signage and vehicular and pedestrian traffic flow as per Section 1 05 00 - Traffic Control, or as directed by Owner's Representative.

.2 Clean and dry pavement surface.

.3 If required, remove existing markings and repair pavement surface as per Section 3 01 20 - Pavement Cleaning and Marking Removal.

.4 Pre-mark all intended lines and symbols.

.1 Lines to be pre-marked at a minimum off-set of 150 mm.

.2 Symbols to be pre-marked by outline.

.3 All markings shall be within 12 mm of location as specified on construction drawings.

.4 The Municipality's Traffic Engineer or designate to inspect and approve pre-markings.

.5 Any correction to pre-marking shall be at contractor's expense.

3.4 INSTALLATION

.1 Paint application as per Section 3 10 10 - Painted Traffic Lines and Markings.

.2 Hot thermoplastic application as per Section 3 10 20 - Thermoplastic Pavement Markings.

.3 Cold Plastic application as per Section 3 10 30 – Cold Plastic Pavement Markings.

4 Measurement and Payment

.1 Measurement and payment for pavement markings is specified in the following sections:

.1 Section 3 10 10 – Painted Traffic Lines and Markings

.2 Section 3 10 20 – Thermoplastic Pavement Markings

.3 Section 3 10 30 – Cold Plastic Pavement Markings

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1-GP-74M, Standard For: Paint, Traffic, Alkyd

.2 CAN/CGSB-1.5, Low Flash Petroleum Spirits Thinner

.2 SOR/2009-264 Schedule 1, Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations

.3 Master Painters Institute (MPI)

1.2 SUBMITTALS

.1 Submit in accordance with Section 1 04 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.

2 Products

2.1 MATERIALS

.1 Paint and Markings:

.1 Alkyd zone/traffic marking to CGSB 1-GP-74M.

.2 Traffic Marking Coatings: maximum VOC limit 450g/L to SOR/2009-264 Schedule 1.

.3 White 513-301

.4 Yellow 505-308

.5 Upon request, Owner’s Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but the Owner’s Representative reserves right to perform further tests.

.2 Thinner: to CAN/CGSB-1.5

3 Execution

3.1 EXAMINATION

.1 Verification of Existing Conditions: verify the condition of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.

.2 Ensure pavement surface is dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.

.3 Proceed with Work only after unacceptable conditions have been rectified.

3.2 EQUIPMENT REQUIREMENTS

.1 Paint applicator: pressure type with positive shut-off distributor capable of applying paint in single, double, and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.

.2 Owner's Representative to approve paint applicator prior to use.

3.3 APPLICATION

.1 Unless otherwise approved by the Owner's Representative, apply paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.

.2 Apply traffic paint evenly at rate of 0.33 L/m^2.

.3 Do not thin paint unless approved by the Owner's Representative.

.4 Symbols and letters to dimensions indicated on drawings.

.5 Paint lines of uniform colour and density with sharp edges.

.6 Thoroughly clean distributor tank before refilling with paint of different colour.

3.4 TOLERANCE

.1 Paint markings: shall be within plus or minus 12mm of dimensions indicated on drawings.

.2 Remove incorrect markings in accordance with Section 3 01 20 - Pavement Cleaning and Marking Removal.

3.5 CLEANING

.1 Progress Cleaning: Leave Work area clean at end of each day.

.2 Final Cleaning: refer to 1 11 00 Closeout Procedures.

3.6 PROTECTION

.1 Protect pavement markings until dry.

.2 Repair damage to adjacent materials caused by pavement marking application.

4 Measurement and Payment

4.1 PAINTED TRAFFIC LINES AND MARKINGS

.1 Line markings: Measured in lineal metres based on length of line markings installed.

.2 Arrows, Symbols, and letters: Measured in specified units based on the number of units installed.

.3 The unit price for painted pavement markings shall include the supply of all materials, equipment, and labour to complete the installation of painted pavement markings.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D570, Standard Test Method for Water Absorption of Plastics

.2 ASTM E28, Standard Test Methods for Softening Point of Resins Derived from Pine Chemicals and Hydrocarbons, by Ring-and-Ball Apparatus

.3 ASTM D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

.4 ASTM D2240, Standard Test Method for Rubber Property – Durometer Hardness.

.5 ASTMD1214, Standard Test Method for Sieve Analysis of Glass Spheres.

.2 Manual of Uniform Traffic Control Devices for Canada, as published by the National Committee on Uniform Traffic Control and distributed by the Transportation Association of Canada.

1.2 SUBMITTALS

.1 Submit in accordance with Section 1 04 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish, and limitations.

2 Products

2.1 THERMOPLASTIC PAVEMENT MARKINGS

.1 The materials shall be manufactured to be applied by extrusion onto the pavement in molten form with glass spheres mixed in. Glass spheres can also be dropped onto the material immediately after it is applied.

.2 The compound shall not deteriorate by contact with asphaltic cement in asphalt concrete materials, sodium chloride, calcium chloride or other chemicals used against formation of ice on roadways or streets or because of oil content of pavement materials or from oil droppings from traffic. In the plastic state, the materials shall not give off fumes which are toxic or otherwise injurious to persons or property. The material shall not break down or deteriorate if held at the plastic temperature for a period of four (4) hours or by reason of four (4) reheatings to the plastic temperature. The temperature versus viscosity characteristics of the plastic material shall remain constant through up to four (4) reheatings and shall be the same from batch to batch. There shall be no obvious change in colour of the material as a result of up to four (4)

reheatings or from batch to batch. To ensure the best possible adhesion, the compound, as specified, shall be installed in a melted state at a minimum temperature of 190°C and the material shall not scorch or discolour if kept at this temperature for up to four (4) hours.

.3 No discolouration from sunlight ultraviolet exposure and no bond failure for the warranted life of the material.

.4 During manufacturing, reflectorizing glass spheres shall be mixed into the material to the extent of not less than twenty (20) percent nor more than fifty (50) percent by weight of the material. Glass spheres shall also be automatically applied to the surface of the material at a uniform rate of approximately three (3) pounds of glass spheres to every one-hundred square feet of line. These glass spheres shall be dropped onto the thermoplastic material while it is in a molten state immediately after it has been extruded onto the pavement.

.5 The drying time shall not exceed a characteristics straight line curve, the lower limits of which are two minutes at 10°C, the upper limits of which are fifteen (15) minutes at 32°C, both temperatures measured at a maximum relative humidity of seventy (70) minutes. Do not permit traffic over applied markings until they have adequately hardened.

.6 Physical Requirements - Pavement Markings

.1 Colour: Marking shall be brilliant white or yellow. Brightness is the value obtained with the Gardner Multi-Purpose Reflectometer when measuring 0 - 45 daylight luminous directional reflectance with the green filter. The rating so obtained shall not be less the seventy (70) percent for white or fifty-five (55) percent for yellow.

.2 Water Absorption: Materials shall have no more than 0.5 percent by weight of retained water when tested by ASTM D570, Procedure (A) (24-hour Immersion).

.3 Softening Point: Materials shall have a softening point of not less than 90°C as determined by ASTM E28.

.4 Specific Gravity: Specific gravity of the thermoplastic compound at 25°C shall be from 1.9 to 2.5.

.5 Impact Resistance: Shall not be less than 1.13 Newton-Metres at 25 C after the material has been heated for four hours at 204°C and cast into bars of 25 mm cross-sectional area, 75mm long and placed with 25 mm extending above the vice in a cantilever beam (Izod type) tester using the 2.82 Newton-Metre scale. This instrument is described in ASTM D256 Method C.

.6 Abrasion Resistance: Materials shall have a maximum weight loss of 0.6 grams when subjected to 200 revolutions on a Taber Abrader at 25°C using H-22 Calibrade wheels weighted to 500 grams. The test samples shall be prepared by forming representative lots of materials at a thickness of 3 mm ± 0.1 mm on a 100 mm square plate. The test surface shall be kept wet during the test.

.7 Indentation Resistance: The reading of the Shore Durometer, Type A2, as described in ASTM D2240, after fifteen (15) seconds and using a 0.907 kilogram weight, shall not be less than the amounts specified below when material is tested after heating for temperatures.

Temperature	Reading
45°C	65 ± 2
25°C	95 ± 2

.8 Chemical Resistance to anti-freeze, brake fluid, motor oil, diesel fuel. Gasoline, calcium chloride, sodium chloride, transmission fluid: 5cm x 5cm test sections should show no signs of degradation after exposure to:

- 5% NaCl (24-hour Immersion)
- 5% CaCl (24-hour Immersion)

.9 Reheating: The thermoplastic compound shall maintain proper performance properties when heated 4 times to the application temperatures. After heating to 200°C for 6 hours while continually stirring at 50 to 100 RPM, the Brookfield viscosity shall not exceed 16,000 cps at 12 RPM.

.10 General Requirements - Glass Beads

.1 Imperfections: The surface of the spheres shall be smooth and free from film, scratches, and pits. At least ninety (90) percent shall be of true spherical shape and free from milkiness, dark or air inclusions and other defects.

.2 Index of Refraction: The liquid immersion method of 25°C may be used to determine the refractive index of glass spheres. A refractive index of 1.50 to 1.60 is required.

.3 Gradation: the spheres shall meet the following gradation requirements when tested in accordance with ASTM designation D1214.

.4 Spheres included in the manufacture of the thermoplastic material:

U.S. Standard Sieve	Percent Passing
Passing #270 um	80-100
Passing #100 um	0-10

.5 Spheres for application on molten thermoplastic material:

U.S. Standard Sieve	Percent Passing
Passing #900 um	90-100
Passing #300 um	20-50
Passing #200 um	0-10

3 Execution

3.1 GENERAL

.1 The thermoplastic material shall be installed in a groove ground into the pavement surface. The material shall completely fill the groove and extend not less than 2.0mm above the pavement surface.

3.2 EXISTING PAVEMENT MARKINGS

.1 Where the location of the new thermoplastic markings conflict with existing pavement markings, such as paint, the new marking shall be installed in the same line as the existing marking, ensuring that the routed groove completely removed the previous marking material.

3.3 APPLICATION

.1 The thermoplastic markings shall not be installed over a longitudinal joint or seam except transverse markings such as stop lines and crosswalk lines.

.2 All work must be done on a clean dry road surface. All grooves must be clean and dry before the material is installed.

.3 To ensure the best possible adhesion, the material shall be applied in a melted state at a minimum temperature of 190°C for white markings and 175°C for yellow markings.

3.4 TRAFFIC CONTROL AND WORK AREA

.1 The Contractor shall always keep traffic congestion to a minimum. The work shall be undertaken from one lane and all men, materials and equipment shall be contained as much as possible in that lane. The work shall be carried out as quickly as possible to prevent excessive delay and inconvenience to traffic.

.2 All equipment or combination of equipment used in application, including the grinder, vacuum machine or sweeper, material applicator and cone truck shall operate within 100 metres at one time.

.3 No grooving of the roadway will be permitted beyond what can be cleaned and inlaid with thermoplastic material in that day.

3.5 PREMARKINGS

.1 The Contractor is responsible for premarking all work. Premarking must be done on a clean dry road surface. All premarking is to be done with premarking paint approved by the Owner’s Representative.

.2 All premarking shall be approved by the Owner’s Representative prior to the installation of the thermoplastic markings. Changes in the alignment of markings that

do not correspond to the plans may be made in the field by the Owner's Representative. Any changes made in the field must be recorded by the Contractor on plans issued by the owner and returned to the owner within seven (7) working days after completion of the job.

.3 Any premarking lines remaining after a period of six (6) weeks must be removed or blacked out by the Contractor at his expense.

.4 Final markings should be installed as soon as possible but no later than seven (7) calendar days after premarking.

3.6 ADHESION TO PAVEMENT

.1 The Contractor shall make all tests and take all samples necessary to assure adequate adhesion between the thermoplastic material and the pavement. Acceptance of this Contract shall be evidence that the Contractor is satisfied that no adhesion problems will be encountered.

3.7 WORKMANSHIP

.1 Faulty markings such as insufficient or wrong filling of grooves, unstraight lines, too much overflow or non-uniform lengths must be re-done within five (5) working days.

.2 The Contractor shall remedy all defects in the work due to faulty material or workmanship or failure of the work itself for a period of two (2) years from the date of the Substantial Completion Certificate.

.3 The Owner's Representative shall give the Contractor written notice of all defects observed within the maintenance period. The maintenance shall be a continuous operation and shall be carried on until expiration of the maintenance period, unless there is an outstanding order from the Owner's Representative requiring the Contractor to correct some of the maintenance that has not been completed. The maintenance period shall be in effect until such time as the Owner's Representative issues a Final Completion Certificate.

3.8 TYPES OF MARKINGS

.1 Centre Line

.1 Shall be 100 mm wide, yellow in colour, solid or broken and may be a single line or two parallel lines separated by a distance of 100 mm. When broken, the directional dividing line shall consist of a line three (3) metres long with a six (6) metre skip distance between lines in a consecutive pattern. The depth of directional dividing line markings shall be 7 mm, 5 mm below and 2 mm above pavement surface, unless specified otherwise.

.2 Lane Line

.1 Shall be a single line, 100 mm wide, white in colour and may be broken or solid. When broken, the lane shall consist of a line three (3) metres long with a six (6) metre skip distance between lines in a consecutive pattern. The depth of lane line markings shall be 7 mm, 5 mm below and 2 mm above pavement surface, unless specified otherwise.

.3 Channelization Lines

.1 Shall be single line, 200 mm wide white in colour and may be broken or solid. When broken, the continuity line shall consist of a line three (3) metres long with a three (3) metre skip distance between lines in a consecutive pattern. The depth of continuity line markings shall be 7 mm, 5 mm below and 2 mm above pavement surface, unless specified otherwise.

.4 Stop Lines

.1 Shall be a single solid line, 400 mm wide and white in colour. The depth of stop line markings shall be 12 mm, 10 mm below and 2 mm above pavement surface, unless specified otherwise.

.5 Crosswalk Lines

.1 Standard intersection crosswalks shall be two parallel solid lines 200 mm wide and white in colour. The depth of crosswalk line markings shall be 12 mm, 10 mm below and 2 mm above pavement surface, unless specified otherwise.

.2 Standard mid-block crosswalk lines shall be 600mm wide white in colour, min 3.0m long arrayed across the street by 600mm. The depth of crosswalk line markings shall be 12 mm, 10 mm below and 2 mm above pavement surface, unless specified otherwise.

.6 Arrows

.1 Shall be white and designed according to the Uniform Traffic Control Device Manual for Canada. The depth of arrow markings shall be 12 mm, 10 mm below and 2 mm above pavement surface, unless specified otherwise.

4 Measurement and Payment

4.1 THERMOPLASTIC PAVEMENT MARKINGS

.1 Thermoplastic pavement markings shall be measured as follows:

.1 Line markings: Measured in lineal metres based on length of line markings installed.

.2 Arrows, Symbols, and letters: Measured in specified units based on the number of units installed.

.3 The unit price for thermoplastic pavement markings shall include the supply of all materials, equipment and labour required to complete the installation of thermoplastic pavement markings.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D570, Standard Test Method for Water Absorption of Plastics

.2 ASTM E28, Standard Test Methods for Softening Point of Resins Derived from Pine Chemicals and Hydrocarbons, by Ring-and-Ball Apparatus

.3 ASTM D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

.4 ASTM D2240, Standard Test Method for Rubber Property – Durometer Hardness.

.5 ASTMD1214, Standard Test Method for Sieve Analysis of Glass Spheres.

.2 Manual of Uniform Traffic Control Devices for Canada, as published by the National Committee on Uniform Traffic Control and distributed by the Transportation Association of Canada.

1.2 SUBMITTALS

.1 Submit in accordance with Section 1 04 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.

2 Products

2.1 COLD PLASTIC PAVEMENT MARKINGS

.1 Physical Requirements - Pavement Markings

.1 Two-component, cold-extruded and cold-curing, having a specific gravity of 1.9 minimum at 25ºC

.2 Colour: Marking shall be brilliant white or yellow. Brightness is the value obtained with the Gardner Multi-Purpose Reflectometer when measuring 0 - 45 daylight luminous directional reflectance with the green filter. The rating so obtained shall not be less the seventy (70) percent for white or fifty-five (55) percent for yellow.

.3 Water Absorption: Materials shall have no more than 0.5 percent by weight of retained water when tested by ASTM D570, Procedure (A) (24-hour Immersion).

.4 Softening Point: Materials shall have a softening point of not less than 90°C as determined by ASTM E28.

.5 Impact Resistance: Shall not be less than 1.13 Newton-Metres at 25 C after the material has been heated for four hours at 204°C and cast into bars of 25 mm cross-sectional area, 75mm long and placed with 25 mm extending above the vice in a cantilever beam (Izod type) tester using the 2.82 Newton-Metre scale. This instrument is described in ASTM D256 Method C.

.6 Abrasion Resistance: Materials shall have a maximum weight loss of 0.6 grams when subjected to 200 revolutions on a Taber Abrader at 25°C using H-22 Calibrade wheels weighted to 500 grams. The test samples shall be prepared by forming representative lots of materials at a thickness of 3 mm ± 0.1 mm on a 100 mm square plate. The test surface shall be kept wet during the test.

.7 Indentation Resistance: The reading of the Shore Durometer, Type A2, as described in ASTM D2240, after fifteen (15) seconds and using a 0.907 kilogram weight, shall not be less than the amounts specified below when material is tested after heating for temperatures.

Temperature	Reading
45°C	65 ± 2
25°C	95 ± 2

.8 Chemical Resistance to anti-freeze, brake fluid, motor oil, diesel fuel. Gasoline, calcium chloride, sodium chloride, transmission fluid: 5cm x 5cm test sections should show no signs of degradation after exposure to:

- 5% NaCl (24-hour Immersion)
- 5% CaCl (24-hour Immersion)

.9 General Requirements - Glass Beads

.1 Imperfections: The surface of the spheres shall be smooth and free from film, scratches, and pits. At least ninety (90) percent shall be of true spherical shape and free from milkiness, dark or air inclusions and other defects.

.2 Index of Refraction: The liquid immersion method of 25°C may be used to determine the refractive index of glass spheres. A refractive index of 1.50 to 1.60 is required.

.3 Gradation: the spheres shall meet the following gradation requirements when tested in accordance with ASTM designation D1214.

.4 Spheres included in the manufacture of the thermoplastic material:

U.S. Standard Sieve	Percent Passing
Passing #270 um	80-100
Passing #100 um	0-10

.5 Spheres for application on molten thermoplastic material:

U.S. Standard Sieve	Percent Passing
Passing #900 um	90-100
Passing #300 um	20-50
Passing #200 um	0-10

3 Execution

3.1 EXISTING PAVEMENT MARKINGS

.1 Where the location of the new markings conflict with existing pavement markings, such as paint, the new marking shall be installed in the same line as the existing marking.

.2 Remove conflicting markings.

3.2 APPLICATION

.1 Sweep or air blow pavement surface to be clean and dry.

.2 Mix components and apply cold plastic marking according to manufacturer's surface application procedure, to a thickness of 2.0 mm minimum and 3.0 mm maximum.

.3 Apply plastic markings in accordance with manufactures instructions and procedures.

.4 Apply glass beads to surface of extruded material before it has set at a rate of 140 to 250 g/m^2.

.5 Do not permit traffic over applied markings until they have adequately hardened.

.6 The markings shall not be installed over a longitudinal joint or seam except transverse markings such as stop lines and crosswalk lines.

.7 All work must be done on a clean dry road surface.

3.3 TRAFFIC CONTROL AND WORK AREA

.1 The Contractor shall always keep traffic congestion to a minimum. The work shall be undertaken from one lane and all men, materials and equipment shall be contained as much as possible in that lane. The work shall be carried out as quickly as possible to prevent excessive delay and inconvenience to traffic.

3.4 PREMARKINGS

.1 The Contractor is responsible for premarking all work. Premarking must be done on a clean dry road surface. All premarking is to be done with premarking paint approved by the Owner's Representative.

.2 All premarking shall be approved by the Owner's Representative prior to the installation of the thermoplastic markings. Changes in the alignment of markings that do not correspond to the plans may be made in the field by the Owner's Representative. Any changes made in the field must be recorded by the Contractor on plans issued by the owner and returned to the owner within seven (7) working days after completion of the job.

.3 Any premarking lines remaining after a period of six (6) weeks must be removed or blacked out by the Contractor at his expense.

.4 Final markings should be installed as soon as possible but no later than seven (7) calendar days after premarking.

3.5 ADHESION TO PAVEMENT

.1 The Contractor shall make all tests and take all samples necessary to assure adequate adhesion between the pavement marking material and the pavement. Acceptance of this Contract shall be evidence that the Contractor is satisfied that no adhesion problems will be encountered.

3.6 WORKMANSHIP

.1 Faulty markings such as incorrect thickness, unstraight lines, too much overflow or non-uniform lengths must be re-done within five (5) working days.

.2 The Contractor shall remedy all defects in the work due to faulty material or workmanship or failure of the work itself for a period of two (2) years from the date of the Substantial Completion Certificate.

.3 The Owner's Representative shall give the Contractor written notice of all defects observed within the maintenance period. The maintenance shall be a continuous operation and shall be carried on until expiration of the maintenance period, unless there is an outstanding order from the Owner's Representative requiring the Contractor to correct some of the maintenance that has not been completed. The maintenance period shall be in effect until such time as the Owner's Representative issues a Final Completion Certificate.

3.7 TYPES OF MARKINGS

.1 Centre Line

.1 Shall be 100 mm wide, yellow in colour, solid or broken and may be a single line or two parallel lines separated by a distance of 100 mm. When broken, the directional dividing line shall consist of a line three (3) metres long with a six (6) metre skip distance between lines in a consecutive pattern.

.2 Lane Line

.1 Shall be a single line, 100 mm wide, white in colour and may be broken or solid. When broken, the lane shall consist of a line three (3) metres long with a six (6) metre skip distance between lines in a consecutive pattern.

.3 Channelization Lines

.1 Shall be single line, 200 mm wide white in colour and may be broken or solid. When broken, the continuity line shall consist of a line three (3) metres long with a three (3) metre skip distance between lines in a consecutive pattern.

.4 Stop Lines

.1 Shall be a single solid line, 400 mm wide and white in colour.

.5 Crosswalk Lines

.1 Standard intersection crosswalks shall be two parallel solid lines 200 mm wide and white in colour.

.2 Standard mid-block crosswalk lines shall be 600mm wide white in colour, min 3.0m long arrayed across the street by 600mm.

.6 Arrows

.1 Shall be white and designed according to the Uniform Traffic Control Device Manual for Canada.

4 Measurement and Payment

4.1 THERMOPLASTIC PAVEMENT MARKINGS

.1 Cold Plastic pavement markings shall be measured as follows:

.1 Line markings: Measured in lineal metres based on length of line markings installed.

.2 Arrows, Symbols, and letters: Measured in specified units based on the number of units installed.

.3 The unit price for thermoplastic pavement markings shall include the supply of all materials, equipment and labour required to complete the installation of thermoplastic pavement markings.

END OF SECTION

1 General

1.1 SCOPE OF WORK

.1 This Section includes the supply and installation of chain link fence and gates.

1.2 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.2 ASTM A90/A90M, Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.3 ASTM A121, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.

.4 ASTM F626, Standard Specification for Fence Fittings.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-138.1, Fabric for Chain Link Fence.

.2 CAN/CGSB-138.2, Steel Framework for Chain Link Fence.

.3 CAN/CGSB-138.3, Installation of Chain Link Fence.

.4 CAN/CGSB-138.4, Gates for Chain Link Fence.

.5 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

2 Products

2.1 CHAIN LINK FABRIC

.1 Conforming to CAN/CGSB-138.1

.1 Manufactured from the highest quality zinc coated wire in accordance with CAN/CGSB-138.1, Type 1, Class B, medium style, Grade 1 or Grade 2.

.2	Nominal wire diameter:	3.5 mm (9-gauge)
.3	Mesh Size:	50 mm
.4	Fabric height:	0.9 m – 3.65 m
.5	Coating:	Zinc – Grade 1 366 g/m^2
		Zinc – Grade 2 490 g/m^2

.2 Selvedge: twisted or knuckled top and knuckled bottom.

2.2 FENCE FRAMEWORK

.1 Conforming to CAN/CGSB-138.2:

.1 Posts and rails: hot-dip galvanized cold rolled welded steel pipe (ASTM A53, Grade A, Schedule 40), zinc coated at minimum 550 g/m^2, and with the following minimum dimensions:

Top Rail:	
Outside Diameter (OD)	42.2 mm – 3.56 mm wall
Line Post:	
Outside Diameter (OD)	
- Fabric height under 1.8 m	48.3 mm – 3.68 mm wall
- Fabric height between 1.8 m and 2.4 m	60.3 mm – 3.91 mm wall
- Fabric height over 2.4 m	73.0 mm - 5.16 mm wall
Length	762 mm longer than height of fabric

Terminal Post – End and Corners:	
Outside diameter (OD)	
Fabric height under 1.8 m	73.0 mm – 3.68 mm wall
Fabric height between 1.8 m and 2.4 m	88.9 mm – 5.49 mm wall
Fabric height over 2.4 m	114.3 mm – 6.02 mm wall
Length	
Fence without barbed wire and corner posts for fence with barbed wire	1.066 m longer than height of fabric
Fence with barbed wire	1.372 m longer than height of fabric
Terminal Post – Gates:	
Outside Diameter (OD)	
Gate with panel length* under 3.0 m	88.9 mm – 5.489 mm wall
Gate with panel length between 3.0 m and 4.5 m*	114.3 mm – 6.902 mm wall

Terminal Post – End and Corners:	
Gate and panel length* between 4.5 m and 7.5 m	168.3 mm - 7.11 mm wall
Length	
Fence without barbed wire	1.066 m longer than height of fabric
Fence with barbed wire	1.372 m longer than height of fabric

*Panel length is opening size for single swinging gates and one half of opening size for double swinging gates.

.2 Bottom Tension wire: 3.5 mm (9-gauge) galvanized steel wire, zinc-coated to match chain link fabric, attached at 600 mm intervals.

2.3 BARBED WIRE OVERHANG

.1 May be specified, on drawings, in the work item only for fences 1.8 m or higher:

.1 End, Corner and Gate Posts: End and gate posts to be 1.372 m longer than fabric height when barbed wire overhang is specified. Corner posts to be 1.066 m longer than fabric height with corner barber wire arms when barbed wire overhand is specified.

.2 Barb Arms: with eyes to hold top rail; to hold 3 strands of barbed wire, top strand to be 300 mm above fabric; vertical or at 45° overhang, as specified.

.3 Barbed Wire: conforming to ASTM A121, with 3 strands, 2 wire each strand, each wire 2.5 mm diameter (12.5-gauge), zinc-coated at minimum 245 g/m^2 (Class 3). Barbs to have 4 points at 150 mm maximum spacing.

2.4 GATE

.1 Gate Fabric: to match fence fabric in 2.1.1

.2 Gate Frame: 42.2 mm OD for panels up to 3.0 m in length, 48.3 mm OD for panels over 3.0 m in length’ electrically welded at all points.

.3 Gate Fittings: galvanized steel industrial hinges allowing an opening of at least 90°, drop pin latch with provision for padlock. Both latch and padlock accessible from both sides.

.4 Double Gate: complete with one foot bolt.

.5 Gate Barbed Wire: if required, to match fence barbed wire.

2.5 FITTINGS

.1 Conforming to ASTM F626 as follows:

Item	Minimum Dimensions (mm)	Minimum Zinc Coating	Material
Post Cap and Rail End	N/A	366 g/m^2	Pressed steel, cast iron or die cast aluminium
Top Rail Sleeve	150 long	366 g/m^2	Round steel tubing
Tie Wire	3.5 diameter (9-gauge)	N/A	Aluminium
Tension & Brace Bands	2.0 thick x 19.0 wide	366 g/m^2	Pressed steel
Tension Bar	4.75 x 19.0	366 g/m^2	Steel strip
Barb Arm	2.0 thick (14-gauge)	366 g/m^2	Pressed steel

2.6 CONCRETE FOR POST FOOTING

.1 20.0 MPa at 28 days.

3 Execution

3.1 SITE PREPARATION

.1 Grading:

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

.1 Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

3.2 ERECTION OF FENCE

.1 Erect fence along lines as indicated and to CAN/CGSB-138.3.

.2 Excavate post holes to dimensions indicated in 3.3.1.

.3 Space line posts 3 m apart, measured parallel to ground surface.

.4 Space straining posts at equal intervals not to exceed 150 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than 150 m.

.5 Install additional straining posts at sharp changes in grade and where directed by the Owner's Representative.

.6 Install corner post where change in alignment exceeds 10 degrees.

.7 Install end posts at end of fence and at buildings.

.1 Install gate posts on both sides of gate openings.

.8 Place concrete in post holes then embed posts into concrete to depths indicated.

.1 Extend concrete 50 mm above ground level and slope to drain away from posts.

.2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.9 Install fence fabric after concrete has cured, minimum of 5 days.

.10 Install brace between end and gate posts and nearest line post.

.1 Install braces on both sides of corner and straining posts in similar manner.

.11 Install overhang tops and caps.

.12 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

.13 Install bottom tension wire, stretch tightly, and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate, and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals.

.1 Knuckled selvedge at bottom.

.2 Twisted selvedge at top.

.15 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals.

.1 Give tie wires minimum two twists.

.16 Install barbed wire strands and clip securely to lugs of each projection.

.17 Install grounding rods as indicated.

3.3 POST SETTING

.1 Post Hole: drilled to the following minimum diameters and depths.

Pipe Diameter	Hole Diameter	Depth of Hole
60.3 mm	250 mm	914 mm
73.0 mm	300 mm	1,143 mm
88.9 mm	350 mm	1,371 mm
114.3 mm	450 mm	1,524 mm

.2 Concrete Footing: Concrete is placed in post hole and post is embedded.

3.4 TOP RAIL

.1 Top rail is supported at each line post with a line post cap so that a continuous brace is formed between terminal posts. Rails are joined with sleeves to allow for expansion and contraction.

.2 Top rail is securely fastened to terminal posts using rail ends and brace bands.

3.5 TERMINAL POST BRACING

.1 Bracing installed from end and gate posts to nearest line post at midpanel and parallel to top rail. Note: Bracing not required for fences 1.83 m or under.

.2 Braces installed on both sides of corner posts in a similar manner.

3.6 BOTTOM TENSION WIRE

.1 Installed within the bottom 150 mm of fabric. Wire is stretch taut and free of sag, fastened securely to end, corner, gate, and straining posts. Hog rings are used to fasten wire to the fabric at 600 mm spacing.

3.7 CHAIN LINK FABRIC

.1 Fabric is placed outside of area to be enclosed.

.2 Fabric is stretched to recommended tension and fastened to end, corner and gate posts using a tension bar and tension bands at 300 mm spacing.

.3 Fabric is secured with tie wire to line posts at 300 mm spacing and top rail at 450 mm spacing.

.4 Installed fabric shall have a smooth, uniform appearance free of sag, dent, and bulge.

3.8 BARBED WIRE OVERHAND

.1 If barbed wire is specified, barb arms are installed in lieu of caps on top of line posts. Overhang is positioned towards area enclosed, unless otherwise directed.

.2 Each barbed wire strand is stretched taut and free of sag, firmly attached into slots of barb arms and secure to end and gate posts.

3.9 WORKMANSHIP

.1 The installed chain link fence shall be free of any defect or imperfection that can affect its serviceability and appearance. The fence shall follow the ground contours smoothly without sharp changes in grade.

4 Measurement and Payment

4.1 CHAIN LINK FENCE

.1 Chain link fence will be measured in lineal metres of fence installed, including gates and removable panels. The unit rate for chain link fence will include the supply and installation of chain link fence including all labour, material, and equipment for each fence category specified in the Bid Form.

END OF SECTION

1 General

1.1 DESCRIPTION

.1 This section covers the design, supply and installation requirements for the manufactured modular block retaining wall as shown on the civil drawings.

1.2 REFERENCES STANDARDS

.1 National Concrete Masonry Association (NCMA) Design Manual for Segmental Retaining Walls

.2 ASTM D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

.3 Design manuals for Lock Block™ Gravity Wall System.

1.3 DELIVERY STORAGE AND HANDLING

.1 Store and protect retaining wall components in accordance with manufacturers requirements.

.2 Do not incorporate damaged components into work.

1.4 SUBMITTALS

.1 Submit design drawings showing wall geometry, construction, and details to the Owner's Representative for review. Drawings to be sealed by a Professional Engineer registered in the Province of Alberta.

2 Products

2.1 MATERIALS

.1 Definitions:

.1 Modular concrete retaining wall units are dry-cast solid concrete units that form the external facia of a modular unit retaining wall system.

.2 Coping units are the last course of concrete units used to finish the top of the wall.

.3 Retained soil is an in-situ soil or a specified soil that is placed behind the wall that provides drainage.

.4 Foundation soil is the in-situ soil beneath the wall structure.

.5 Drainage aggregate is a free draining soil with natural soil filtering capabilities, or a free draining soil encapsulated in a suitable geotextile, or a combination of free draining soil and perforated pipe all wrapped in a geotextile, placed directly behind the modular concrete units.

.6 Drainage pipe is a perforated polyethylene pipe used to carry water, collected at the base of the retaining wall, to outlets to prevent pore water pressures from building up behind the wall facing modules.

.7 Non-woven geotextiles are permeable synthetic fabrics formed from a random arrangement of fibers in a planar structure. They allow the passage of water from one soil medium to another while preventing the migration of fine particles that might clog a drainage medium.

.2 Products:

.1 Interlocking blocks

.1 Interlocking block system to used as specified on the drawings.

.2 Retained Soil

.1 The retained soil shall be on site soils or as directed by the Owner's Representative. If imported fill is required, it shall be examined and approved by the Owner's Representative.

.3 Foundation Soil

.1 The foundation soil shall be the native undisturbed on-site soils. The foundation soil shall be examined and approval by the Owner's Representative prior to the placement of the base material.

.4 Leveling Base Material

.1 The footing material shall be non-frost susceptible, well graded compacted crushed stone as required and specified by wall design requirements or a concrete leveling base.

.5 Drainage Soil

.1 The drainage soil shall be a free draining angular granular material as required and specified by the wall design requirements.

.6 Drainage Pipe

.1 The drainage pipe shall be perforated corrugated HDPE or PVC pipe, with a minimum diameter of 100 mm (4 inches), protected by a geotextile filter to prevent the migration of soil particles into the pipe, or as specified on the construction drawings.

.7 Geotextile Filter

.1 The non-woven geotextile shall be installed as required and specified by wall design requirements.

.2 Approved Products: Nilex "Non-Woven" geotextile No. 4553 or an approved equivalent.

.8 Geosynthetic Reinforcement

.1 Approved Products: Strategrid; Tensar; Miragrid; Nilex

3 Execution

3.1 CONSTRUCTION

.1 Construction Tolerances

.1 The following tolerances are the maximum allowable deviation from the planned construction:

.1 Vertical Control: +/- 30 mm over a 3 m distance, +/- 75 mm total

.2 Horizontal Control: +/- 30 mm over a 3 m distance, 300 mm total

.3 Rotation: +/- 2 degrees from planned wall batter

.4 Bulging: 25 mm over a 3 m distance.

.2 Site Preparation

.1 The foundation soil shall be excavated or filled as required to the grades and dimensions shown on the approved design drawings or as directed by the Owner's Representative.

.2 The foundation soil shall be proof rolled and examined by the Owner's Representative to ensure that it meets the minimum strength requirements according to the design assumptions. If unacceptable foundation soil is encountered, the contractor shall excavate the affected areas and replace with suitable quality material under the direction of the Owner's Representative.

.3 In cut situations, the native soil shall be excavated to the lines and grades shown on the approved design drawings and removed from the site or stockpiled for reuse as retained soil.

.3 Installing Drainage System

.1 The approved non-woven geotextile shall be set against the back of the first retaining wall unit, over the prepared foundation, and extend towards the back of the excavation, up the excavation face and back over the top of the drainage material to the retaining wall, or as shown in the approved design drawings.

.2 The drainage pipe shall be placed behind the leveling base, or lower course of facing units or as directed by the Owner's Representative. The pipe shall be laid at a minimum gradient of 2% to ensure adequate drainage to free outlets.

.3 T – Sections and outlet pipes shall be installed on the drainage pipe at 15 m centers or as shown on the design drawings.

.4 The remaining length of geotextile shall be pulled taut and pinned over the face of the retained soil. Geotextile overlaps shall be a minimum of 300 mm and shall be shingled down the face of the excavation to prevent the infiltration of retained soil into the drainage layer.

.4 Installation of Modular Concrete Retaining Wall Units

.1 The bottom row of retaining wall modules shall be placed on the prepared leveling base as shown on the approved design drawings. Care shall be taken to ensure that the wall modules are aligned properly, leveled from side to side and front to back and are in complete contact with the base material.

.2 The wall modules above the bottom course shall be placed such that the interlocking arrangement provides the design batter (i.e., setback) of the wall face. Successive courses shall be placed to create a running bond pattern with the edge of all units beginning approximately aligned with the middle of the unit in the course below it.

.3 The wall modules shall be swept clean before placing additional levels to ensure that no dirt, concrete or other foreign materials become lodged between successive lifts of the wall modules.

.4 A maximum of 3 courses of wall units can be placed above the level of the drainage material at any time.

.5 The contractor shall check the level of wall modules with each lift to ensure that no gaps are formed between successive lifts.

.6 Care shall be taken to ensure that the wall units are not broken or damaged during handling and placement.

.5 Leveling Base or Spread Footing Placement.

.1 The leveling base material shall be crushed stone compacted to 98% Standard Proctor Density, or vibrated concrete along the grades and dimensions shown on the drawings.

.6 Drainage Soil

.1 The drainage soil will be placed behind the retaining wall modules with a minimum width of 600 mm and separated from other soils using the approved non-woven geotextile.

.2 Drainage soil shall be placed behind the wall facing in maximum lifts of 150 mm and compacted to a minimum density of 95% Standard Proctor.

.3 No heavy compaction equipment shall be allowed within 1 metre of the back of the wall facia.

.7 Retained Soil

.1 Retained soils shall be placed and compacted behind the drainage material in maximum lift thickness of 150 mm. The retained soils shall be undisturbed native material or engineered fill compacted to a minimum density as shown on the drawings.

.2 No heavy compaction equipment shall be allowed within 1 m of the back of the wall modules.

.8 Finishing Wall

.1 Coping units shall be secured to the top of the wall with two 10 mm (3/8 inch) beads of the approved flexible concrete adhesive positioned 50 mm (2 inches) in front and behind the tongue of the last course of retaining wall units.

.2 Finish grading above the wall to direct surface run off water away from the segmental retaining wall. Use a soil with a low permeability to restrict the rate of water infiltration into the retaining wall structure.

4 Measurement and Payment

.1 Interlocking block retaining wall system shall be measured and paid for by the surface area of the exposed wall face measured from finished final grade to top of wall. Price to include all labour, equipment, materials, and incidentals required to construct wall in accordance with these specifications.

END OF SECTION

1 General

1.1 REFERENCES

.1 ASTM B209M, Standard Specification for Aluminium and Aluminium-Alloy Sheet and Plate (Metric)

.2 Manual of Uniform Traffic Control Devices for Canada (MUTCDC), as published by the National Committee on Uniform Traffic Control and distributed by the Transportation Association of Canada.

.3 CGSB-62-GP-12C, Marking Material, Retroreflective Elements Flexible Type.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 1 04 00 – Submittal Procedures for signs not conforming to the MUTCDC.

2 Products

2.1 MATERIALS

.1 Standard Tubular Metal Supports for Small Signs (Maximum Sign Size: 750 mm x 750 mm):

.1 To be Telespar Signpost System installed in soil.

.2 One 2.4 or 3.0 m (post) section of 12-gauge, 44 mm square tubing, hot dipped galvanized steel with 11 mm diameter punched holes on 25 mm centres, full length on four sides.

.3 One 1 m section (base) of 12-gauge, 50 mm square tubing, hot dipped galvanized steel with 11 mm diameter punched holes on 25 mm centres, full length on four sides.

.4 One 46 cm section (sleeve) of 12-gauge, 57 mm square tubing, hot dipped galvanized steel with 11 mm diameter punched holes on 25 mm centres, full length on four sides.

.2 Vertical Tubular Support

.1 Steel Breakaways to be used for all signs installed in medians, in concrete, or where the presence of underground utilities prevents use of Telespar post.

.1 May be used for signs ranging in size from 750 mm x 750 mm to a maximum of 1200 mm x 900 mm.

.2 Above ground post structure to consist of:

.1 Pipe: 50 mm I.D. Schedule 40 galvanized, pre-cut to required length.

.2 Pipe outside diameter: 57 mm to 60 mm

.3 Pipe inside diameter: 50 mm.

.4 Pipe wall thickness: 3.2 mm (minimum).

.5 Plate: 102 mm x 102 mm x 6.35 mm steel plate, with 4 pre-drilled 10 mm holes at each corner, 20 mm in from each plate edge.

.6 Plate to be welded to one end of pipe.

.7 Drill a 15 mm hole in post 30 mm up from plate (for water drainage from post).

.3 At/below ground post structure to consist of:

.1 Plate: 102 mm x 102 mm x 6.35 mm steel plate, with 4 pre-drilled 10 mm holes at each corner, 20 mm in from each plate edge.

.2 Pipe: 50 mm ID black steel pipe or equivalent.

.3 Pipe wall thickness: 9 mm.

.4 Pipe length: 305 mm

.5 Weld a 102 mm x 19 mm rebar horizontally onto pipe approximately 115 mm from bottom.

.6 Weld plate to top of post (opposite end to rebar).

.2 Steel elbows to be used on Parking Meter posts.

.1 32 mm, Schedule 40, black steel pipe, welded 152 mm out and 152 mm down from base of meter.

.2 Cut at 45-degree angle, weld all around, prime weld and paint silver in colour.

.3 Oversize Breakaways

.1 To be used on signs larger than 1200 mm x 900 mm

.2 Above ground post structure to consist of:

.1 Pipe: 77 mm I.D. Schedule 40 galvanized, pre-cut to required length.

.2 Pipe outside diameter: 90 mm

.3 Pipe inside diameter: 77 mm

.4 Pipe wall thickness: 5 mm

.5 Plate: 150 mm x 150 mm x 10 mm steel plate, with 4 pre-drilled 12 mm holes at each corner, 30 mm from each plate edge.

.6 Drill a 15 mm hole in post 30 mm up from plate (for water drainage from post).

.3 At/below ground post structure to consist of:

.1 Plate: 150 mm x 150 mm x 10 mm steel plate, with 4 pre-drilled 12 mm holes at each corner, 30 mm from each plate edge.

.2 Pipe: 77 mm I.D. black steel pipe or equivalent.

.3 Pipe wall thickness: 9 mm

.4 Pipe length 760 mm

.5 Weld a 150 mm x 30 mm rebar horizontally onto pipe approximately 1200 mm from bottom.

.6 Weld plate to top of post (opposite end to rebar)

.3 Sign Material

.1 Aluminium Sheet: To ASTM B209M, pre-cut to required dimensions with corners rounded to meet MUTCDC standards. Thickness to be 0.081 sign grade aluminium.

.2 Aluminium Extrusions: pre-cut to required dimensions. Extruded aluminium Alcan #6063-T6C street sign blade.

.3 Crezone – 75 mm, medium density overlaid Douglas Fir, premium grade, good one side.

.4 Primer for Crezone: Premium Alkyd Exterior Enamel undercoat.

.5 Finish paint: All exterior grade enamel to appropriate colour.

.4 Fasteners

.1 Bolts, nuts, washers, and other hardware for roadside signs to be cast aluminium alloy, or galvanized steel. Stainless gear clamp HS 32. Coarse plated 6 mm x 32 mm. NC Grade 5 hexicap screws from break away posts (concrete base). Street name bracket K-6 or K-9 for side mount, ID-28 for top mount (Alberta Traffic Supply) or equivalent. Bandit strapping materials for 13 mm bandit strapping.

.5 Silk Screen Ink

.1 Appropriate ink to be used for the substrate being printed on.

.2 Acceptable ink product:

.1 3M series 880I process ink.

.6 Reflective Sheeting and Tape

.1 3M VIP Diamond Grade #3990 on all stop, yield, playground and school zone signs and 3M High Intensity 3930 series on all other regulatory signs.

.2 Vinyl 3M-220 series or equivalent.

.3 Refer to CGSB 62-GP-12C.

.7 Clear Vinyl Protective Coat

.1 3M 1150 series clear/transparent.

2.2 FABRICATION

.1 Crezone Sign Board Blanks

.1 Cut crezone blanks to required shapes and dimensions. Fill edges with wood filler suitable for outdoor use and sand smooth.

.2 Lightly sand surfaces and wipe clean.

.3 Paint signboard back edges with one prime coat and two finish coats in the same colour as the sign face.

.2 Aluminium Sign Blanks

.1 Clean surfaces with Dupont Enamel Reducer or approved equal and allow to thoroughly dry.

.2 Reflective background sheeting and lettering:

.1 Cut and apply in accordance with manufacturer’s instructions.

.2 Apply pressure sensitive material with roller or squeegee.

.3 Match pieces of sheeting from different rolls for each signboard to ensure uniform appearance and brilliance by day and night.

.4 Reflective signboard faces must be prepared using 3M series 880I process ink for silkscreen.

.5 Non-reflective lettering and symbols to be cut from 3M 220 series or equivalent, vinyl film or silkscreen ink appropriate for type of sheeting.

.6 Protect finished signboard faces with cut lettering with one overlay of transparent vinyl.

.3 Sign Identification

.1 Mark the back of each sign with “Regional Municipality of Wood Buffalo”. Lettering to be 13 mm (minimum) high black letters, using outdoor non-fading ink covered with 3M-3669 clear vinyl.

3 Execution

3.1 INSTALLATION

.1 Sign Support

.1 Erect supports as indicated. Permissible tolerance: 50 mm maximum departure from vertical for direct buried supports.

.2 Erect posts plumb and square to details as indicated.

.2 Telespar Signpost Systems

.1 Attached sleeve and base together flush at the top and drive unit to required depth, without damage, leaving 150 mm (minimum) of base/sleeve exposed to attach post.

.3 Steel Breakaways

.1 Base is placed in concrete with approximately 75 mm to 100 mm maximum of pipe exposed above ground, ensuring drainage away from pipe.

.2 Use four 25 mm x 10 mm steel bolts, to attach post to base plate.

.3 In finished concrete surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.

.4 Signboard

.1 Fasten signboard to Telespar post with bolts, nuts, and washers; to Steel Breakaways with stainless gear clamp HS32; to street or traffic light standards with bandit strapping materials.

.2 Use strapping with crimped or bolted connections where signs fastened to light poles (no fastening allowed to wooden utility poles).

.3 Fasten street markers using K-6, K-9, or ID-28 (Alberta Traffic Supply) or equivalent, bracket and aluminium bolts.

3.2 REPAIR/RESTORATION

.1 Prepare new message on 0.081 aluminium sheet.

.2 Replace damaged sign with new sign.

3.3 PROTECTION

.1 Place temporary covering on signboards where indicated. Covering to be capable of withstanding rain, snow and wind and be non-injurious to signboard. Replace deteriorated covering and remove covers as directed by Owner’s Representative.

3.4 CORRECTING DEFECTS

.1 Correct defects identified by Owner's Representative in sign message, consistency of reflectivity, colour, or illumination. Correct angle of signboard and adjust luminaire aiming angle for optimum performance during night conditions to approval of Owner's Representative.

3.5 REMOVAL AND SALVAGE

.1 Carefully dismantle and salvage aluminium materials.

.2 Salvage or dispose of existing materials in an approved method.

.3 Contact the Public Works Office to determine delivery time.

.4 Deliver materials to Public Works Yard and unload at designated drop-off location.

3.6 COMPLIANCE

.1 Regulatory Traffic Control Signs

.1 Regulatory traffic control signs must be completely installed as illustrated on the approved construction Drawings and in accordance with the MUTCDC and Municipal Standards, prior to eliminating construction zone signage and allowing non-construction motor vehicles to travel on the constructed roadway.

.2 Non-Regulatory Signs

.1 Non-regulatory signs must be installed as per the approved construction Drawings and in accordance with the MUTCDC and Municipal Standards within two weeks of Substantial Completion.

.3 Completion of Sign Installation

.1 Owner's Representative may extend the time allowed to complete the sign installation, providing the Contractor submits a written request to the Owner's Representative.

4 Measurement and Payment

.1 Measurement for supply, installation and painting of signboards will be based on individual units.

.2 Measurement for supply and installation of luminaire and bracket combinations will be based on individual units, including all wiring, conduit, and accessories.

.3 Measurement for supply, installation and painting of sign supports will be based on each complete sign installation.

.4 Measurement for supply, installation and painting of signboards, sign supports, luminaires and bracket combinations including all wiring conduit and accessories will be based on each complete sign installation.

END OF SECTION

1 General

.1 This Section specifies requirements for supplying and installing steel W-beam guide rail for medians and roadsides.

1.2 REFERENCES

.1 AASHTO M180, Standard Specification for Corrugated Sheet Steel Beams for Highway Guardrail

.2 ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength

.3 Canadian Standards Association (CSA)

.1 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles

.2 CGSB-1.181-92, Ready-Mixed Organic Zinc-Rich Coating

.3 CAN/CSA 080.0, General Requirements for Wood Preservation

2 PRODUCTS

2.1 MATERIALS

.1 Steel W-beam guide rail:

.1 Steel rail and terminal sections to AASHTO M180, Class A (Type 1 zinc coated).

.2 Bolts, nuts and washers to ASTM A307, hot dip galvanized to CSA G164.

.3 Organic zinc-rich coating to CGSB-1.181-92. Sawn timber post and offset block:

.1 Construction grade lumber, pressure treated in accordance with CAN/CSA 080.0.

.2 Dimensions as indicated on drawings.

3 EXECUTION

3.1 W-BEAM GUIDE RAIL INSTALLATION

.1 Install posts plumb at locations and to depths as indicated or as directed by Owner’s Representative.

.2 Excavate post holes and compact bottom to provide firm foundation. Set post plumb and square in hole.

.3 Backfill around post using excavated material and compact in uniform layers not exceeding 150 mm compacted thickness to ground elevation.

.4 Place 50mm of compacted material above existing ground elevation to ensure drainage away from posts.

.5 Cut off tops of posts as indicated on drawings.

.6 Construct anchorages to details as indicated. Place and compact backfill for anchors as directed by Owner's Representative.

.7 Erect steel W-beam components to details as indicated. Lap joints in direction of traffic. Tighten nuts to 100 N.m torque. Maximum protrusion of bolt 6 mm beyond nut.

3.2 ATTACHMENT TO CONCRETE STRUCTURE

.1 When the terminal point is attached to a concrete structure, install a galvanized C150 x 12 x 7.6 m long channel below the W-beam guide rail, as shown on the drawings.

3.3 PAINTING/TOUCH UP

.1 Galvanized steel touch up:

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas.

.2 Pre-treat damaged surfaces according to manufacturer's instructions for zinc-rich paint.

4 Measurement and Payment

4.1 W-BEAM GUIDE RAIL

.1 Supply and installation of roadside steel W-beam guide rail including posts and necessary hardware will be measured in metres of guide rail installed and measured from outer tips of steel W-beam guide rail, including guide rail used in anchorages and terminal sections.

.2 The unit price for W-beam guide rail shall include the supply of materials for posts and rails, installation of posts, installation of guide rail, and all labour and equipment required to complete the installation in accordance with this Section.

END OF SECTION

1 General

.1 This work consists of the erection of guideposts.

1.2 SUBMITTALS

1.3 INCLUDE SECTIONS AS REQUIRED

2 Products

.1 The contractor shall supply flexible guideposts which return to upright positions following repeated impacts and passages of vehicles over them. Such collisions shall not cause serious damage to the post or vehicle. Failure to conform to the requirements specified herein shall be cause for rejection.

2.1 GENERAL

.1 The posts shall be of uniform high quality and workmanship and free from defects.

.2 Prior to installation, the Contractor shall provide a complete report of the physical properties of the post to the Owner's Representative. This report shall include properties such as low temperature impact resistance, after-impact recoverability, and weather resistance.

2.2 SPECIFICATIONS – DIMENSIONS, COLOUR AND CONSTRUCTION

.1 The round posts shall have a minimum outside diameter of 90 mm and an overall length of 1.67 m. The semi-flat fibreglass posts shall have a minimum width of 90 mm and an overall length of 1.67 m.

.2 The top 250 mm of post length shall be black, and the remainder shall be white.

.3 The post shall be straight. Straight is defined as having no point along the length of the post any more than 6 mm removed from a perfectly straight edge placed parallel to any side of the post.

.4 Round posts shall be open at the top and bottom.

.5 The surface of the post shall be smooth and free from irregularities or defects. The surface of the post shall not be affected by cleaning using scrapers, detergent with water, or solvent.

.6 Reflective sheeting shall be securely fastened to the black portion of the post with three stainless steel staples inserted through the overlapped portion of the reflective strip.

.7 If one piece construction is not used, then the connections between the pieces shall be at least as strong as if constructed of a single piece. The strength shall exist at temperatures ranging from -50°C to 50°C.

.8 The reflective portion of round posts shall be visible from all directions and shall be of sufficient size to be recognizable in the dark as a guidepost deflector. The reflective portion of semi-flat posts shall be visible to traffic.

2.3 WEATHER RESISTANCE AND DURABILITY

.1 The post shall not be seriously affected by ozone, exhaust fumes, asphalt or road oils, dirt, vegetation, de-icing salts, or any other types of air contamination or materials likely to be encountered after installation.

.2 The post shall withstand without serious damage all elements likely to be encountered after installation including hot (50°C) or cold (-50°C) temperatures, rain, snow, hail, abrasion, and physical abuse.

2.4 STRENGTH AND FLEXIBILITY

.1 The posts shall resist, without breaking, tearing, shattering or other serious damage, one highway vehicle impact at a speed of 100 km/h at a test temperature of -33°C.

.2 The post shall not bend, warp, or distort when installed at temperatures up to 50°C or installed in wind velocities up to 120 km/h.

2.5 REFLECTIVE SHEETING

.1 The reflective sheeting material shall be super-high intensity retroreflective sheeting meeting the minimum requirements as specified in ASTM D4956 for a Type X sheeting with Class I pressure sensitive adhesive backing.

.2 Each post shall have a 100 mm wide x 330 mm long strip of reflective sheeting fastened onto the black portion of the post. The reflective sheeting shall be centred in such a manner that 75 mm of the black portion is exposed both above and below the attached reflective strip.

.3 Generally, the colour of the reflective strip shall be either white or fluorescent yellow to match the colour of the nearest painted roadway edge line. When marking the edges of approaches located on curves or other concealed access points as directed by the Owner’s Representative, the colour of the reflective sheet shall be green. When green reflective sheeting is required, white sheeting shall be screen printed green using a process recommended by the sheeting manufacturer.

3 Execution

3.1 GENERAL

.1 Guideposts shall be accurately set to the required depth and alignment, in a manner resulting in a smooth continuous installation, as shown on the Drawings or as directed by the Owner's Representative. Permissible tolerance for plumb and grade of posts shall be 6 mm maximum.

.2 Holes shall be excavated by auger. The diameter of the holes augered shall be of sufficient size to allow for pneumatic tamping. Prior to digging any holes, the Contractor shall contact all applicable utility companies to arrange for utility location and marking.

.3 Unsuitable material at the bottom of the holes excavated shall be replaced with granular material at the Contractor's expense, as directed by the Owner's Representative. The Contractor shall thoroughly compact the bottom of the hole. The guideposts shall rest directly and solidly on the bottom of the hole at the time of installation.

.4 Excavated material which is unsuitable for use as backfill shall be substituted with granular material by the Contractor at his expense. Backfill shall be thoroughly compacted, using pneumatic tampers, in layers not exceeding 150 mm, for the full depth of the excavation.

.5 Reflectors shall be attached by mechanical means such as stapling. Fastening by adhesives alone will not accepted.

.6 The colour of the reflectors shall be either white or fluorescent yellow to match the colour of the nearest painted roadway edge.

.7 Upon completion of the installation, the work area shall be restored to its original condition.

3.2 TOLERANCE

.1 At the end of the warranty period, the permissible tolerance for plumb and grade of all posts shall be 13 mm.

4 Measurement and Payment

.1 Measurement will be made of the number of each type of guidepost installed.

.2 Payment will be made at the applicable unit price bid per guidepost. This payment shall be full compensation for supplying and installing the new posts.

.3 No separate payment will be made for guidepost removal. The removal and disposal of existing guideposts is considered incidental to the Work.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C144, Standard Specification for Aggregate for Masonry Mortar.

.2 ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA-A3000, Cementitious Materials Compendium.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Divert left over aggregate materials from landfill to local facility for reuse as approved by Owner's Representative.

.2 Divert left over hardened cement materials to landfill for reuse as approved by Owner's Representative.

.3 Divert left over geotextiles to local plastic recycling facility as approved by Owner's Representative.

2 Products

2.1 STONE

.1 Hard, dense with relative density (formally specific gravity) not less than 2.65, durable quarry stone, free from seams, cracks, or other structural defects. Granite, quartzite, and limestone are preferred; sandstone mud stone, shale or slate are not acceptable.

.2 Stone rip rap to be smooth surface and outline the following:

.1 Class 1 Rip Rap

.1 100% of total volume of stones with individual size less than 450 mm.

.2 Not less than 50% of total volume of stones with the individual volume less than 350 mm.

.3 Remaining Percentage of total volume to have uniform distribution of stones between 200 mm and 300 mm.

.2 Class 2 Rip Rap

.1 100% of total volume of stones with individual size less than 800 mm.

.2 Not less than 50% of total volume of stones with the individual volume less than 600 mm.

.3 Remaining Percentage of total volume to have uniform distribution of stones between 300 mm and 500 mm.

.3 Class 3 Rip Rap

.1 100% of the total volume of stones with individual size less than 1100 mm.

.2 Not less than 50% of the total volume of stones with the individual volume less than 900 mm.

.3 Remaining percental of total volume to have a uniform distribution of stones between 500 mm and 800 mm.

2.2 CEMENT MORTAR

.1 Cement: to CAN/CSA-A3000, type 10.

.2 Sand for mortar: to ASTM C144.

.3 Fly ash cement: to ASTM C618.

2.3 GEOTEXTILE FILTER

.1 Geotextile: in accordance with Section 3 05 30 - Geotextiles.

3 Execution

3.1 PLACING

.1 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.

.2 Prepare a trench at the toe and top of the slope, as shown on the drawings, anchor geotextile by backfilling trench with granular material.

.3 Transport rock to the site, dump and place in a manner that minimizes cracking and spalling and avoids damage to filter.

.4 Remove material that does not comply with the gradation or specification.

.5 Place geotextile on prepared surface. Place rip rap on geotextile to avoid puncturing geotextile. Do not drive vehicles directly on geotextile.

.6 Place rip rap in a manner such that segregation into different sizes does not occur.

.7 Do not use heavy machinery on material in place.

.8 Place rip rap to a depth equal to or exceeding the largest permitted rock size for the class specified.

.9 Place stones in manner approved by Owner’s Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.

.10 Hand placing:

.1 Use larger stones for lower courses and as headers for subsequent courses.

.2 Stagger vertical joints and fill voids with rock spalls or cobbles.

.3 Finish surface even, free of large openings and neat in appearance.

4 Measurement and Payment

.1 Supply and install rip rap will be measured and paid for per square metre (m^2) of rip rap installed. Unit price to include supply and installation of rip rap, supply and installation of geotextile, trenching, excavation and backfill of key trench, and all other labour, equipment and materials incidental to the work.

END OF SECTION

1 General

1.1 DEFINITIONS

.1 Clearing consists of cutting off trees and brush vegetative growth to not more 300 mm above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

.2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps, and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.

.3 Clearing isolated trees consists of cutting off to not more than 300 mm above ground of designated trees and disposing of felled trees and debris.

.4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of all fallen timber and surface debris.

.5 Grubbing consists of excavation and disposal of stumps and roots, boulders, and rock fragments of specified size to not less than a specified depth below existing ground surface.

.6 Mulching consists of shredding trees, tree stumps and tree roots into wood chips small enough to be used for landscaping.

1.2 STORAGE AND PROTECTION

.1 Prevent damage to fencing, benchmarks, existing buildings, existing pavement, utility lines, site appurtenances, water courses which are to remain.

.1 Repair any damaged items to approval of Owner’s Representative.

.2 Replace any trees designated to remain, if damaged, as directed by Owner’s Representative.

2 Products

2.1 MATERIALS

.1 Not used.

3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust or adjacent properties.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction.

3.2 PREPARATION

.1 Inspect site and verify with Owner's Representative, items designated to remain.

.2 Tree cutting must avoid the breeding season for bird species, to be in compliance with the intent of the Migratory Birds Conservation Act. The migratory bird nesting period is April 14 to August 31. Owner's Representative will complete an assessment conducted by a Professional Biologist to determine the recommended migratory bird nesting period prior to performing any work.

.3 All work within Caribou Habitat Zones will require approval from Alberta Environment and Parks and must comply with the conditions of the approval.

.4 Notify utility authorities before starting clearing. Plant material shall not be removed from any Municipal or Environmental Reserve without written approval from Municipal Parks Department.

.5 The Contractor shall locate and protect all utilities, survey control monuments, plant material and root systems that are designated to remain, including natural features, pavement, concrete and structures. Preserve in operating condition active utilities traversing site.

.6 Plant material shall not be removed from any Municipal or Environmental Reserve without written approval from Municipal Parks Department.

.7 All designated plant material to be removed shall be permitted to be disposed of at an environmentally approved offsite location. No burning will be permitted.

.8 All roots and stumps shall be removed to a minimum depth to 0.6m below rough grade.

.9 Root systems shall not be disturbed within 10m or the drip line of any plant material to remain, whichever is greater.

.10 All areas disturbed during the development process must be rehabilitated to its original state or better, as directed by Municipal Parks Department.

3.3 CLEARING

.1 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas at an environmentally approved location.

.2 Cut off trees, brush and shrubs at ground level.

.3 Cut down dangerous trees overhanging area cleared.

3.4 CLOSE CUT CLEARING

.1 Close cut clearing to ground level.

.2 Cut off branches, down trees overhanging area cleared as directed by Owner's Representative.

.3 Cut off unsound branches on trees designated to remain as directed by Owner's Representative.

3.5 ISOLATED TREES

.1 Cut off isolated trees as indicated by Owner's Representative at height of not more than 300 mm above ground surface.

.2 Grub out isolated tree stumps and dispose at an environmentally approved location.

3.6 UNDERBRUSH CLEARING

.1 Clear underbrush from areas as indicated at ground level of ground surface.

3.7 GRUBBING

.1 Grub out stumps and roots to not less than 200 mm below ground surface.

.2 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m^3.

3.8 MULCHING

.1 Onsite mulching is permitted provided the Contractor removes and disposes the mulch to an offsite location.

3.9 REMOVAL AND DISPOSAL

.1 Cleared materials are to be removed from site and disposed of at an environmentally approved location.

.2 Cut timber greater than 125 mm diameter and stockpile. Stockpiled timber becomes property of Contractor. Contractor to remove stockpiled timbers from site in a timely manner.

.3 The Contractor has the option of marketing any of this timber.

3.10 FINISHED SURFACE

.1 Leave ground surface in condition suitable for stripping of topsoil to approval of Owner's Representative.

4 Measurement and Payment

.1 Clearing and grubbing shall be made measured in hectares (ha) based on the field measured area cleared and grubbed.

.2 The unit price is to include all equipment labour, materials, equipment, and disposal of all materials off-site at an approved disposal site.

END OF SECTION

1 General

1.1 EXISTING CONDITIONS

.1 Examine available subsurface investigation reports.

.2 Known underground and surface utility lines and buried objects are as indicated on site plan.

.3 Refer to dewatering in Section 2 01 00 - Excavating Trenching and Backfilling.

1.2 PROTECTION

.1 Prior to construction, protect and/or transplant existing fencing, trees, landscaping, natural features, benchmarks, buildings, pavement, surface or underground utility lines which are to remain as directed by Owner's Representative. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

2 Products

2.1 MATERIALS

.1 Fill material: Type 2 in accordance with Section 3 04 00 – Aggregate Materials.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Owner's Representative.

3 Execution

3.1 TOPSOIL STRIPPING

.1 Limit stripping to the area required to complete the work or as indicated on the Drawings.

.2 Load, haul, and place in stockpiles in designated area or as indicated by the Owner's Representative.

.3 Stockpile in a manner that will not endanger person, the work or adjacent property.

.4 Keep topsoil stockpiles separate and do not mix with common excavation.

.5 Maintain a minimum 1.0m separation between topsoil and common excavation material when stockpiling.

.6 For long term storage of stockpiled material provide weed and erosion control measures.

.7 If the topsoil and subsoil are mixed and the topsoil is adversely affected, the Contractor shall at their own expense, engage a soils specialist to determine the necessary remedial work and shall perform the required work.

3.2 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface.

.2 Slope rough grade away from structures and equipment laydown.

.3 Grade ditches to depth as indicated.

.4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.5 Compact filled and disturbed areas as in Section 3 04 00 – Aggregate Materials and Section 2 01 00 – Excavating, Trenching and Backfilling.

.6 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 TESTING

.1 Submit testing procedure, frequency of tests to Owner's Representative for approval.

3.4 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping off site to an environmentally approved location.

3.5 MATERIAL DISPOSAL

.1 The Contractor is to provide a Materials Control Plan indicating what material will be disposed of and where. The plan is to be updated throughout construction and indicate:

.1 Description of material.

.2 Date of disposal.

.3 Location of disposal.

.4 Approximate quantity of material disposed of.

.2 Any construction material hauled to municipal sites for storage, must be free from contaminated materials and suitable for re-use. If the condition of the material is unknown, then the Contractor is to get permission from the Owner's Representative before hauling the material to a municipal site.

.3 The Owner's Representative may at anytime inspect the materials deposited to municipal sites. If the Contractor is found to be depositing unsuitable material at municipal sites, such action will be considered a violation of their contract agreement. The contractor will be required to remove the material at their own cost and may be subject to charges as per the RMWB Bylaws.

4 Measurement and Payment

4.1 TOPSOIL STRIPPING

.1 Topsoil stripping shall include stripping topsoil and organic material from designated areas and to depths designated by the Owners Representative, loading, transporting, and stockpiling on the site or hauling to disposal. Cleanup, and all incidental work for which payment is not specified elsewhere. Unit price bid per cubic meters of topsoil stripped, as determined by survey cross-section of stripping area before and after stripping.

4.2 SITE GRADING

.1 Site grading shall include excavation, loading, transporting, and/or stockpiling, filling of embankments., moisture conditioning and compaction to specified densities on the site or hauling to disposal. Cleanup, trimming and all incidental work for which payment is not specified elsewhere. Unit price bid per cubic meters of common material excavated, as determined by survey cross-section of cut areas area before and after grading.

4.3 IMPORT MATERIAL

.1 The Contractor shall source suitable fill material to be imported for used for site grading. Contractor to provide materials testing results from a Geotechnical Consultant to confirm suitability of the material for use onsite prior to commencing import. Should the material change during the import activities and be determined unsuitable, it will be the Contractor's responsibility to remove the material from site and find a new source.

.2 Payment for import shall be made at the unit price bid per cubic meter of material hauled to site as verified by field survey.

4.4 MATERIAL DISPOSAL

.1 Material Disposal shall be paid in for by the cubic meter (m3). Volumes will be measured by field survey. Price to include all equipment, materials, labour, excavation, loading, hauling and the disposal of material at an off-site location approved by the Regional Municipality of Wood Buffalo. Alternative sites will be considered at the request of the Contractor. No extra payment will be made for excavation beyond the limits identified by the Engineer.

END OF SECTION

1 General

1.1 REFERENCES

.1 Agriculture and Agri-Food Canada

.1 The Canadian System of Soil Classification

.2 Canadian Council of Ministers of the Environment

.1 PN 1340, Guidelines for Compost Quality.

1.2 DEFINITIONS

.1 Compost:

.1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.

.2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss on Iginition (LOI) test.

.3 Product must be sufficiently decomposed (i.e., stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below 25) and contain no toxic or growth inhibiting contaminates.

1.3 ACTION AND INFORMATION SUBMITTALS

.1 Provide submittals in accordance with Section 1 04 00 – Submittal Procedures.

.2 Quality control submittals:

.1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2.4 – SOURCE QUALITY CONTROL.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Divert unused chemical soil amendments from landfill to official hazardous material collections site approved by Owner’s Representative.

.3 Do not dispose of unused chemical soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

2 Products

2.1 TOPSOIL

.1 Mixture of particulates, micro-organisms and organic matter which provides suitable medium for supporting intended plant growth.

.1 Acceptable minimum levels for general use are as follows:

.1	Sand:	40%
.2	Clay:	25%
.3	Silt:	35%
.4	Organic Matter:	10%
.5	Nitrogen – N	90lbs/acre
.6	Phosphorus – P	140lbs/acre
.7	Potassium – K	250lbs/acre
.8	Toxic Chemicals:	None
.9	Electrical Conductivity:	4 mmhos max
.10	pH Value:	6.0 to 7.5

.2 All soils must fall within the Clay Loam classification as defined by the Canadian Soils Classification System, and total composition of silts and clays must not exceed 65% of total particle distribution.

2.2 PEAT MOSS:

.1 Decomposed plant material, elastic and homogenous, free from toxic material, live plants, live roots, and seeds, decomposed colloidal residue, wood clay lumps, sulphur and iron. pH value between 4.5 and 6.0 with a conductivity of less than 2 mmhos. Shall contain no more than 200 maximum ppm of sulfate. Shall contain no lime.

2.3 SOIL AMENDMENTS

.1 As directed by Owner's Representative based on soil tests.

.1 Lime

.1 Dry, free-flowing ground limestone containing not less than 85% of total combined carbonates, to the following gradation:

Sieve size (mm)	Minimum % Passing, by Mass
2.5 mm (No. 8)	100
1.25 mm (No. 16)	90 – 100

.2 Organic Matter

.1 Compost, unprocessed organic matter such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability, and contaminant requirements.

.2 Compost to meet the most recent version of Guidelines for Compost Quality published by the Canadian Council of Ministers of the Environment.

.3 Fertilizer

.1 Industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.4 SOURCE QUALITY CONTROL

.1 The Contractor shall provide two soil analysis reports, one for the original soil and one for the amended soil, to the Owner's Representative. All soil is to be approved by the Owner's Representative prior to installation.

.2 The soil analysis report will include the topsoil source and the recommendations for correction to meet the nutritional growing requirements of specified plant materials. Recommendations will clearly state the type and quantity of soil additives and application procedure to be used.

.3 Soil analysis is to include the source location, soil deficiencies, amendments, and recommendations. Topsoil shall be tested for particle size, organic matter (volume), Nitrogen, Phosphorus, Potassium, electrical conductivity (salinity) and pH value.

.4 Testing of topsoil will be carried out by testing laboratory designated by Owner's Representative.

.1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

.2 All costs related to testing shall be borne by the Contractor.

.3 Contractor is responsible for amendments to supply topsoil as specified in PART 2.3 – SOIL AMENDMENTS.

.5 Contractor shall provide representative samples of the topsoil to be used for the intended project.

3 Execution

3.1 PREPARATION OF EXISTING GRADE

.1 Locate runs of utility lines before commencement of work. Protect active lines from damage.

.2 Remove all foreign material, undesirable plants, roots, stones more than 25mm, debris and soil contaminated with oil or gasoline, or any other toxic substance from site and dispose of at an environmentally approved location.

.3 Verify that grades are correct.

.1 If discrepancies occur, notify Owner's Representative, and do not commence work until instructed by Owner's Representative.

.4 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.5 Cultivate entire area which is to receive topsoil to depth of 100 mm.

.1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.2 PLACING AND SPREADING OF TOPSOIL / PLANTING SOIL

.1 Place topsoil after Owner's Representative has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150mm.

.3 For sodded areas keep topsoil 15mm below finished grade or 25mm below adjacent walks, curbs, and manholes.

.4 Spread topsoil in uniform 100 mm layers to following depths after settlement:

.1 100mm for sodded areas

.2 150mm for seeded areas

.3 300mm for perennial beds

.4 500mm tree and shrub beds

.5 Manually spread topsoil/planting soil around trees, shrubs, and obstacles.

.6 Float area until surface is smooth. Cut smooth and flush areas adjacent to catch basin rims. Remove all lumps, rocks, roots, and other debris from the finished material and from the site and dispose at an environmentally approved location.

.7 Compact topsoil with suitable rollers to the satisfaction of the Owner's Representative.

3.3 FINISH GRADING

.1 Fine grade to eliminate rough or low areas and to ensure positive drainage.

.2 Prepare loose friable bed by means of cultivation and subsequent raking.

.3 Consolidate topsoil to required bulk density using equipment approved by Owner's Representative.

.4 Leave surfaces smooth, uniform and firm against deep foot printing.

3.4 ACCEPTANCE

.1 Owner's Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.5 SURPLUS MATERIAL

.1 Dispose of materials except topsoil not required off site as directed by Owner's Representative at an environmentally approved location.

3.6 CLEAN UP

.1 Upon completion remove surplus materials, rubbish, tools, and equipment.

3.7 QUALITY ASSURANCE

.1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

4 Measurement and Payment

.1 Payment for topsoil placement shall be made at the unit price per square meter (m^2) as indicated on the Bid Form, measured from survey of finished area.

.2 For planting beds, unit price shall include all costs to excavate and prepare planting beds (including but not limited to disposal of all foreign materials to designated stockpile, compaction, and scarification); supply, loading, hauling, spreading, placing of topsoil to depths as shown on the Drawings.

.3 Unit price shall include all costs to condition and / or amend topsoil in accordance with this Section, including all testing.

.4 No separate payment will be made for supply and placement of topsoil in tree pits. It is considered incidental to work in other sections of the Specifications.

.5 No separate payment will be made for the disposal of deleterious material off-site to a designated stockpile, or for any incidental necessary to complete this work item in accordance with this Section.

END OF SECTION

1 General

1.1 NOT USED

2 Products

2.1 GRASS SEED

.1 Fine Grass Mixture: Canada "Certified" seed, "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada Seeds Act and Seeds Regulations, according to the following grass seed mixture:

.2

Parks/Boulevards	**Rural Roadside**
• 30% Brooklawn Kentucky Bluegrass • 30% com1 Kentucky Bluegrass • 30% Creeping Red Fescue • 10% Perennial Ryegrass • Application Rate of 75kg/hectare	• 35% Slender/Awned Wheatgrass • 20% Rocky Mountain Fescue • 10% Ticklegrass • 10% Fringed Brome • 10% Canada Wildrye • 10% Tufted Hairgrass • 5% Fowl Bluegrass • Application Rate of 75kg/hectare
Sports Fields - Irrigated	**Sports Fields – Dry Land**
• 20% Award Kentucky Bluegrass • 20% Bedazzled Kentucky Bluegrass • 20% Brooklawn Kentucky Bluegrass • 20% NuDestiny Kentucky Bluegrass • 20% Perennial Rye Grass • Application Rate of 75kg/hectare	• 20% Brooklawn Kentucky Bluegrass • 20% Bedazzled Kentucky Bluegrass • 20% Midnight Kentucky Bluegrass • 20% Tomcat Tall Fescue • 20% Perennial Ryegrass • Application Rate of 75kg/hectare

Natural Areas (tall growing mix)	Natural Areas (low growing mix)
• 30% Rocky Mountain Fescue • 25% Indian Ricegrass • 20% Hairy Wildrye • 10% Junegrass • 10% Canada Bluegrass • 5% Canada Wildrye • Application Rate of 35kg/hectare	• 35% Sheeps Fescue • 30% Rocky Mountain Fescue • 15% Junegrass • 15% Canada Bluegrass • 5% Tufted Hairgrass • Application Rate of 35kg/hectare
Salt Tolerant Mix	
• 40% Fults Alkali Grass • 20% Tomcat tall fescue • 20% Midnight Kentucky Bluegrass • 20% Perennial Ryegrass	

.3 Cover Mixture in accordance with Government of Canada Seeds Act and Seeds Regulations, as specified by the Owner's Representative.

.4 Supply in packages individually labelled in accordance with Seeds Regulations and indicating name of supplier and date bagged.

2.2 WATER

.1 Free of impurities that would inhibit germination and growth.

.2 Supplied by Contractor at no cost to the Owner.

3 Execution

3.1 WORKMANSHIP

.1 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice or standing water.

.2 Remove and dispose of weeds, debris, stones 50 mm in diameter and larger, soil contaminated by oil, gasoline, and other deleterious materials to an environmentally approved location.

3.2 SEED BED PREPARATION

.1 Verify that grades are correct. If discrepancies occur, notify Owner's Representative, and do not commence Work until instructed by Owner's Representative.

.2 Fine grade surface free of humps and hollows to smooth, even grade, to elevations indicated to tolerance of plus or minus 25 mm.

.3 Surface drainage is to be as shown on the site grading plan.

3.3 SEED PLACEMENT

.1 For mechanical seeding:

.1 Use "Brillion" type mechanical landscape seeder with sand discs which accurately places seeds at specified depth and rate and rolls in single operation.
.2 Use equipment and method acceptable to Owner's Representative.

3.4 FOR MANUAL SEEDING:

.1 Use "Cyclone" type manually operated seeder.

.2 Rake surface to ensure seed is properly embedded.

.3 Remove any topsoil lumps more than 50 mm in size.

.4 Use equipment and method acceptable to Owner's Representative.

.5 On cultivated surfaces, uniformly sow fine grass seed at rate of 170 kg/ha and coarse grass seed at rate of 75 kg/ha.

.6 Blend applications 150 to 300 mm into adjacent grass areas and previous applications to form uniform surfaces.

.7 Sow half of required amount of seed in one direction and remainder at right angles.

.8 Embed seed into soil to depth of 6 to 10 mm. Not less than 85% of seed to be placed at specified depth and covered by soil.

.9 Consolidate mechanically seeded areas by rolling area if soil conditions warrant or if directed by Owner's Representative, with equipment approved by Owner's Representative immediately after seeding.

.10 Consolidate manually seeded areas by rolling area with equipment approved by Owner's Representative immediately after seeding.

.11 Protect seeded areas against damage. Remove protection material after lawn areas have been established and accepted by Owner's Representative.

.12 Avoid seeding along a road edge where freshly applied pavement markings may be contaminated or damaged by seed.

3.5 ACCEPTANCE FOR ISSUE OF CONSTRUCTION COMPLETION CERTIFICATE

.1 Seeded areas will be accepted by Owner's Representative provided that:

.1 Areas are uniformly graded and seeded to Clauses 3.1, 3.2 and 3.3 of this Section.

.2 Areas are free of perennial weeds, rocks, and debris.

.2 Deficiencies to be corrected prior to issuance of the Construction Completion Certificate.

3.6 MAINTENANCE DURING WARRANTY PERIOD

.1 From the issue date of the Construction Completion Certificate to the end of the one-year warranty period, perform the following maintenance operations:

.1 Repair and reseed dead or bare spots, repair rutting and areas of settlement to satisfaction of Owner's Representative.

.2 Repaired areas must be cut at least three times and seed must be fully established before area will be accepted.

.3 Cut grass to 50 mm whenever it reaches height of 100 mm.

.4 Eliminate weeds by mechanical means.

4 Measurement and Payment

4.1 MECHANICAL SEEDING

.1 Payment for mechanical seeding shall be made at the unit price per square meters (m^2) of area as shown in the Bid Form.

.2 Measurement shall be based on survey of finished area.

.3 Work includes supply and placement of seed and all accessories, maintenance from hydraulic seeding to acceptance.

.4 No separate payment will be made for the supply, hauling or placement of imported topsoil to prepare for mechanical seeding.

.5 No separate payment will be made for the disposal of deleterious material off-site to a designated stockpile or environmentally approved location.

END OF SECTION

1 General

1.1 PRODUCT DATA

.1 Provide product data for

.1 Seed

.2 Mulch

.3 Tackifier

.4 Fertilizer

.5 Erosion Control Blanket

.6 Anchors

.2 Submit in writing to Owner's Representative 14 days prior to commencing work:

.1 Size of truck slurry tank in litres.

.2 Amount of material to be used per tank based on size of slurry tank.

.3 Number of tank loads required per hectare to achieve specified slurry mixture per hectare.

2 Products

2.1 MATERIALS

.1 Mulch

.1 Fibres: 99% organic content.

.2 Free of growth inhibiting ingredients.

.3 100% potential water uptake by weight.

.4 Capable of dispersing in water to form homogeneous slurry.

.5 Capable of forming an absorptive mat ground cover allowing water percolation.

.2 Tackifier: water dilutable liquid dispersion containing polyvinyl acetate terpolymer emulsion.

.3 Erosion control blanket to be specified by Owner's Representative.

.4 Erosion control blanket anchors:

.1 Staples: single or double prong "U" type, with minimum 2.5 mm diameter wire, minimum 150 mm high.

.2 Pegs: wooden, minimum 25 mm x 25 mm x 200 mm high.

.5 Water: free of impurities that would inhibit germination and growth.

.6 Fertilizer: complete synthetic, with minimum 65% water soluble nitrogen. Ratio: 1:4:1 or approved alternate.

2.2 GRASS SEED

.1 Fine Grass Mixture: Canada "Certified" seed, "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada Seeds Act and Seeds Regulations, according to the following grass seed mixture:

Parks/Boulevards	**Rural Roadside**
• 30% Brooklawn Kentucky Bluegrass • 30% com1 Kentucky Bluegrass • 30% Creeping Red Fescue • 10% Perennial Ryegrass • Application Rate of 75kg/hectare	• 35% Slender/Awned Wheatgrass • 20% Rocky Mountain Fescue • 10% Ticklegrass • 10% Fringed Brome • 10% Canada Wildrye • 10% Tufted Hairgrass • 5% Fowl Bluegrass • Application Rate of 75kg/hectare
Sports Fields - Irrigated	**Sports Fields – Dry Land**
• 20% Award Kentucky Bluegrass • 20% Bedazzled Kentucky Bluegrass • 20% Brooklawn Kentucky Bluegrass • 20% NuDestiny Kentucky Bluegrass • 20% Perennial Rye Grass • Application Rate of 75kg/hectare	• 20% Brooklawn Kentucky Bluegrass • 20% Bedazzled Kentucky Bluegrass • 20% Midnight Kentucky Bluegrass • 20% Tomcat Tall Fescue • 20% Perennial Ryegrass • Application Rate of 75kg/hectare

Natural Areas (tall growing mix)	Natural Areas (low growing mix)
• 30% Rocky Mountain Fescue • 25% Indian Ricegrass • 20% Hairy Wildrye • 10% Junegrass • 10% Canada Bluegrass • 5% Canada Wildrye • Application Rate of 35kg/hectare	• 35% Sheeps Fescue • 30% Rocky Mountain Fescue • 15% Junegrass • 15% Canada Bluegrass • 5% Tufted Hairgrass • Application Rate of 35kg/hectare
Salt Tolerant Mix	
• 40% Fults Alkali Grass • 20% Tomcat tall fescue • 20% Midnight Kentucky Bluegrass • 20% Perennial Ryegrass	

.2 Supply in packages individually labelled in accordance with Seeds Regulations and indicating name of supplier and date bagged.

2.3 EQUIPMENT

.1 Truck to be equipped with a minimum 4500 litre slurry tank and pumps capable of maintaining continuous non-fluctuating flow of solution.

3 Execution

3.1 WORKMANSHIP

.1 Take reasonable care to prevent spraying items such as structures, signs, guardrails, fences, plant materials and utilities.

.2 Do not perform work under adverse field conditions such as wind speeds over 20 km/hour, frozen ground or ground covered with snow, ice or standing water.

3.2 PREPARATION OF SURFACES

.1 Ensure areas to be seeded have been scarified to depth of 300 mm and are moist to depth of 150 mm before seeding. Fine grade free of humps and hollows and free of deleterious and refuse materials.

.2 Obtain Owner’s Representative's approval of topsoil grade and depth before starting to seed.

.3 Avoid seeding along road edge where freshly applied pavement markings may be contaminated or damaged by seeding product.

.1 Slurry Application

.2 Slurry mixture applied per hectare:

.1 Seed: 300 kg.

.2 Mulch: 1600 kg.

.3 Tackifier: 50 kg.

.4 Fertilizer: 450 kg.

.5 Water: quantity as required to form slurry in accordance with manufacturer's recommendations.

.6 Apply seed slurry uniformly.

.7 Blend applications into adjacent grass areas and previous applications to form uniform surfaces.

.8 Reshoot areas where application is not uniform.

.9 Remove slurry from items and areas not designated to be sprayed.

3.3 EROSION CONTROL BLANKET

.1 Apply blanket over designated areas in accordance with manufacturer's instructions.

.2 Anchor blanket in accordance with manufacturer's recommendations which are to be used as minimum standard and ensure that blanket is held down to maintain firm contact with soil.

3.4 ESTABLISHMENT

.1 Cut grass to 50 mm whenever it reaches height of 100 mm from time of seed application until acceptance by Owner’s Representative.

.2 Repair dead or bare spots to allow establishment of seed prior to acceptance.

.3 Eliminate weeds.

3.5 ACCEPTANCE FOR ISSUE OF CONSTRUCTION COMPLETION CERTIFICATE

.1 Seeded areas will be accepted by Owner's Representative provided that:

.1 Areas are uniformly graded and seeded to Clause 3.2 of this Section.

.2 Areas are free of perennial weeds, rocks and debris.

.2 Deficiencies are to be corrected prior to issuance of the Construction Completion Certificate.

3.6 MAINTENANCE DURING WARRANTY PERIOD

.1 From the issue date of the Construction Completion Certificate to the end of the two-year warranty period, perform the following maintenance operations:

.1 Repair and reseed dead or bare spots, repair rutting and areas of

.2 settlement to satisfaction of Owner's Representative.

.3 Cut grass to 50 mm whenever it reaches height of 100 mm.

.4 Eliminate weeds by mechanical means.

3.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Planting and Maintenance Supervisors: "Landscape Industry Certified" Technician as regulated by Canadian Nursery Landscape Association (CNLA).

4 Measurement and Payment

4.1 HYDRAULIC SEEDING

.1 Payment for hydraulic seeding shall be made at the unit price per square meters (m^2) of area as shown in the Bid Form.

.2 Measurement shall be based on survey of finished area.

.3 Work includes supply and placement of seed and all accessories, maintenance from hydraulic seeding to acceptance.

.4 No separate payment will be made for the supply, hauling or placement of imported topsoil to prepare for hydraulic seeding.

.5 No separate payment will be made for the disposal of deleterious material off-site to a designated stockpile or to an environmentally approved location.

END OF SECTION

1 General

1.1 SUBMITTALS

.1 Submit product data in accordance with Section 1 04 00 Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sod and fertilizer and include product characteristics, performance criteria, physical size, finish, and limitations to the Owner's Representative.
.2 Submit two copies of WHMIS MSDS in accordance with Health and Safety requirements to the Owner's Representative.

.3 Samples:

.1 Submit sod for each type specified.
.2 Submit 0.5 kg container of each type of fertilizer used.
.3 Biodegradable geotextile fabric.
.4 Obtain approval of samples by Owner's Representative.

.4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements of seed mix, seed purity, and sod quality.

.5 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties of seed mix, seed purity, and sod quality. The Contractor shall be responsible for the costs of all required testing.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling:

.1 Schedule delivery of sod such that it is delivered within 24 hours of being lifted and lay sod within 36 hours of being lifted.

.2 Schedule sod laying to coincide with preparation of soil surface.

.3 Schedule sod installation when frost is not present in ground.

.4 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

.2 Source Quality Control

.1 Obtain approval from Owner's Representative of sod at source.
.2 When proposed source of sod is approved, use no other source without written authorization.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with supplier's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with supplier's recommendations.

.2 Replace defective or damaged materials with new.

.4 Packaging Waste Management:

.1 Collect and separate for disposal and recycling palettes, crates, padding and packaging materials.

.2 Dispose / recycle materials at appropriate facilities.

.5 Sod must be installed on the day of arrival at site. If delays in installation occur due to weather, protect sod on site from sun, keep moist and store in a cool place until installation. Sod that is dried out and not in a healthy growing condition will be rejected.

1.4 WARRANTY

.1 Contractor hereby warrants that sodded areas will remain free of defects, but for one (1) full growing season, providing adequate maintenance has been provided.

.2 End of warranty inspection will be conducted by Owner's Representative.

2 Products

2.1 MATERIALS

.1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop. Sod showing signs of deterioration due to age or lack of moisture will be rejected. Sod must be free of stones, burns, dry or bare spots, tears and delivered moist, cut in strips of uniform width and thickness and of the following mix or approved equal:

.1 Touchdown Kentucky Bluegrass – 30% by weight

.2 Creeping Red Fescue – 30% by weight

.3 Kentucky Bluegrass – 40% by weight.

.2 Quality:

.1 A minimum of eighteen (18) months old.

.2 Free of noxious weeds and debris.

.3 30mm – 50mm in thickness.

.4 Cut in strips of uniform width.

.5 Shall be sufficiently moist.

.6 Freshly cut and healthy with a strong fibrous root system.

.7 Cultivated in a nursery field as turf crop containing maximum 2% of other grass species.

.3 Water:

.1 Supplied by Contractor at no cost to Owner.
.2 Free of impurities that would inhibit germination and growth.

.4 Fertilizer:

.1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
.2 The type and application rate of starter fertilizer (high in phosphorus and low in nitrogen, i.e., bone meal or monoammonium phosphate) shall be determined by a soil test.
.3 Complete, synthetic, slow-release high nitrogen fertilizer (25-5-10 or as determined by a soil test).

.5 Sod establishment support:

.1 Wooden pegs: 17 x 8 x 200 mm.
.2 Geotextile fabric: biodegradable, 25mm square mesh.

2.2 SOURCE QUALITY CONTROL

.1 Obtain approval of sod at source.

.2 When proposed source of sod is approved, use no other source without written authorization.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sod installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Owner’s Representative.
.2 Inform Owner’s Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Verify that grades are correct and prepared in accordance Section 4 01 40 - Topsoil Placement and Finish Grading. If discrepancies occur, notify Owner's Representative, and do not commence work until instructed.

.2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.

.3 Fine grade surface free of humps and hollows to smooth, even grade, elevations indicated, to tolerance of plus or minus 8 mm, for Turfgrass Nursery Sod, surface to drain naturally.

.4 Remove and dispose of weeds; debris; stones 25 mm in diameter and larger; soil contaminated by oil, gasoline, and other deleterious materials; off site at Contractor's expense to an environmentally approved location.

3.3 SOD PLACEMENT

.1 Ensure sod placement is done under supervision of certified Landscape Planting Supervisor.

.2 Lay sod within 36 hours of being lifted.

.3 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

.4 Roll sod as directed by Owner's Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.4 SOD PLACEMENT ON SLOPES AND PEGGING

.1 Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.

.2 Start laying sod at bottom of slopes.

.3 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to following pattern:

.4 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.

.5 Not less than 25 pegs per 10 square metre.

.6 Drive pegs to 20 mm above soil surface of sod sections.

3.5 FERTILIZING PROGRAM

.1 Apply high nitrogen fertilizer (25-5-10 or as determined by a soil test) twice per season to establish a vigorous stand of turf.

.2 Fertilizer to be granular, water soluble type, applied in accordance with the Manufacturer's written instructions.

3.6 PROTECTION

.1 Erect plastic snow fence around newly seeded areas sufficient to protect against deterioration due to pedestrian or other traffic.

.2 Remove protection devices as directed by Owner's Representative.

3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following operations from time of installation until acceptance.

.1 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition.
.2 Cut grass to 50mm when or prior to it reaching height of 75mm.
.3 Maintain sodded areas weed free 95%.
.4 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
.5 Temporary barriers or signage to be maintained where required to protect newly established sod.

3.8 ACCEPTANCE

.1 Turfgrass Nursery Sod areas will be accepted by Owner's Representative provided that:

.1 Sodded areas are properly established.
.2 Sod is free of bare and dead spots.
.3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
.4 Sodded areas shall have been cut a minimum of 3 times prior to acceptance.

.2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.9 CLEANING

.1 Progress Cleaning:

.1 Leave Work area clean and free from debris at the end of each day.
.2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 1 11 00 Closeout Procedures.

.1 Clean and reinstate areas affected by Work.

3.10 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Planting and Maintenance Supervisors: “Landscape Industry Certified” Technician as regulated by Canadian Nursery Landscape Association (CNLA).

4 Measurement and Payment

.1 Payment for sodding shall be made at the unit price per square metre (m^2) of area as shown in the Bid Form.

.2 Measurement shall be based on survey of finished area.

.3 Work includes supply and placement of sod and all accessories, maintenance from sod placement to acceptance and all other labour, equipment and materials incidental to the work.

.4 No separate payment will be made for the supply, hauling or placement of imported topsoil to prepare sodding.

.5 No separate payment will be made for the disposal of deleterious material off-site to a designated stockpile.

END OF SECTION

1 General

1.1 REFERENCES

.1 Reference Standards:

.1 Agriculture and Agri Food Canada (AAFC).

.1 Plant Hardiness Zones in Canada.

.2 Canadian Nursery Landscape Association (CNLA)

.1 Canadian Standards for Nursery Stock.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.2 SUBMITTALS

.1 Submit in accordance with Section 01 04 00 Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for trees, shrubs, ground cover, fertilizer, anti-desiccant, anchoring equipment, and include product characteristics, performance criteria, physical size, finish, and limitations to the Owner’s Representative.

.2 Submit 2 copies of WHMIS MSDS in accordance with Health and Safety Requirements to the Owner’s Representative.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling: obtain approval from Owner’s Representative of schedule 7 days in advance of shipment of plant material. Schedule to include:

.1 Quantity and type of plant material.

.2 Shipping dates.

.3 Arrival dates on site.

.4 Planting Dates.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.1 Protect plant material from frost, excessive heat, wind, and sun during delivery.

.2 Protect plant material from damage during transportation:

.1 Delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.

.2 Delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.

.3 Protect foliage and root balls using anti desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.

.2 Storage and Handling Requirements:

.1 Immediately store and protect plant material which will not be installed within 24 hours in accordance with supplier's written recommendations and after arrival at site in storage location approved by Owner’s Representative.

.2 Protect stored plant material from frost, wind and sun and as follows:

.1 For pots and containers, maintain moisture level in containers.

.2 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.

.3 Store and manage hazardous materials in accordance with manufacturer's written instructions.

1.5 WARRANTY

.1 Contractor hereby warrants that plant material as itemized on plant list will remain free of defects, but for two (2) full growing seasons, providing adequate maintenance has been provided after planting.

.2 End of warranty inspection will be conducted by Owner’s Representative.

.3 Owner’s Representative reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

2 Products

2.1 PLANT MATERIAL

.1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.

.1 Source of plant material grown in Zone 2a in accordance with Plant Hardiness Zones in Canada.

.2 Plant material must be planted in zone specified as appropriate for its species.

.3 Plant material in location appropriate for its species.

.2 Plant material: free of disease, insects, defects, or injuries and structurally sound with strong fibrous root system.

.3 Trees: with straight stems unless that would be uncharacteristic to the tree species. Clump or multi-stem trees shall have three or more stems originating from a common base.

.4 Collected stock: To be used only with the written approval of the Owner's Representative. Collected stock shall be maximum 40 mm in caliper, with well developed crowns and characteristically branched; no more than 40% of overall height may be free of branches.

.5 Shrubs shall have natural form typical of the species with a minimum of four canes.

.6 Vines shall have at least four runners, each of a minimum length of 300mm.

.7 Ground covers shall have well developed tops, size proportionate to the developed roots typical of the species.

.8 Plant sizes as per Engineering Servicing Standards and Development Procedures (most recent edition):

.1 Minimum coniferous tree size is 2m height.

.2 Minimum deciduous tree size is 50mm caliper.

.3 Minimum coniferous shrub size is 600mm spread.

.4 Minimum deciduous tree size is 600mm height.

.5 Plant sizes may be reduced, at the discretion of Owner's Representative, depending on the species and application.

2.2 WATER

.1 Free of impurities that would inhibit plant growth.

2.3 STAKES

.1 T bar, steel, 50 x 50 x 5 x 2500 mm.

.2 Top 200mm of tree stake colour coded to Engineering Servicing Standards and Development Procedures (most recent edition).

2.4 WIRE TIGHTENER

.1 Type 1: galvanized steel, stamped plate type rod, triangular shape.

2.5 GUYING WIRE

.1 Galvanized #12 guy wire or approved equal.

2.6 GUYING COLLAR

.1 2 ply, reinforced, black rubber hose, or approved equal.

2.7 MULCH

.1 Random-sized wood chips collected from a woodchipper being fed disease free tree limbs, branches and brush is acceptable.

.2 Wood chips should sit for minimum of 6 months before use to ensure the chips are free of any pathogens and to lower acidity. Sawdust, peat moss, twigs, and leafy material should not exceed 5% of the total mulch volume.

.3 Non-wood type mulches must be approved by Owner's Representative prior to installation.

2.8 FERTILIZER

.1 Synthetic commercial type as recommended by soil test report.

2.9 ANTI DESICCANT

.1 Wax like emulsion.

2.10 FLAGGING TAPE

.1 Fluorescent, orange colour.

2.11 SOURCE QUALITY CONTROL

.1 Obtain approval from Owner's Representative of plant material prior to planting.

.2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for planting installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Owner’s Representative.

.2 Inform Owner’s Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

.4 Commencement of planting operations implies acceptance of subgrade.

3.2 PRE-PLANTING PREPARATION

.1 Proceed only after receipt of written acceptance of plant material from Owner’s Representative.

.2 Remove damaged roots and branches from plant material.

.3 Apply anti desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

.4 Locate and protect utility lines.

.5 Notify and acquire written acknowledgment from utility authorities that excavation will not damage utilities before beginning excavation of planting pits for trees and shrubs.

3.3 EXCAVATION AND PREPARATION OF PLANTING BEDS

.1 Excavate and prepare planting beds to depths shown on the Drawings.

.2 For individual planting holes:

.1 Stake out location and obtain approval from Owner’s Representative prior to excavating.

.2 Excavate to depth and width as indicated on drawings. With the approval of the Owner’s Representative, the finished elevation of tree pits can be raised for improved drainage.

.3 Remove rocks, roots, debris, and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material to an environmentally approved location.

.1 Scarify sides of planting hole.

.4 Remove water which enters excavations prior to planting. Notify Owner's Representative if water source is ground water.

3.4 PLANTING

.1 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball.

.1 Do not pull burlap or rope from under root ball.

.2 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.

.3 Plant vertically in locations as indicated.

.1 The root flare must be level with the surrounding soil. If not readily apparent, remove excess soil by hand to reveal the root flare.

.2 Orient plant material to give best appearance in relation to structure, roads, and walks.

.4 For trees and shrubs:

.1 Backfill soil in 150 mm lifts.

.1 Tamp each lift to eliminate air pockets.

.2 When two thirds of depth of planting pit has been backfilled, fill remaining space with water.

.3 After water has penetrated soil, backfill to finish grade.

.4 Form watering saucer as indicated on the Drawings.

.5 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

.6 Water plant material thoroughly.

.7 After soil settlement has occurred, fill with soil to finish grade.

.8 Apply water soluble high phosphorous starter fertilizer (10-52-10, or as determined by soil test).

3.5 TREE SUPPORTS

.1 Install tree stakes as indicated.

.1 Use two (2) stakes for deciduous trees 3m or less in height, and evergreens 2m or less in height.

.2 Use three (3) stakes and anchors for deciduous trees greater 3m in height and evergreens greater than 2.0 m in height.

.3 Install stakes at equal intervals around tree.

.4 Drive stakes 150 mm minimum into undisturbed soil beneath roots.

.1 Ensure stake is secure, vertical and unsplit.

.2 Install stakes away from trunk so guy wire will form minimum 30-degree angle with the ground. Install stake at angle to achieve maximum resistance for guy wire.

.2 Install guying collars above branch to prevent slipping at approximately 2/3 height for evergreens and 1/2 height for deciduous trees. Collar mounting height not to exceed 2.5 m above grade.

.1 Guying collars to be of sufficient length to encircle tree plus 50 mm space for trunk clearance.

.3 Thread guy wire through collar encircling tree trunk and secure to lead wire by clamp or multi wraps; cut wire ends close to wrap. Spread lead wires equally proportioned about trunk at 120 degrees.

.4 Attach guy wire to stakes. Tension wire and secure by installing clamps.

.1 Install wire tightener ensuring that guys are secure and leave room for slight movement of tree.

.5 Install flagging tape to guys as indicated on drawings.

.6 After tree supports have been installed, remove broken branches with clean, sharp tools.

3.6 MULCHING

.1 Ensure soil settlement has been corrected prior to mulching.

.2 There shall be 75mm of mulch placed in planting beds and tree wells.

.3 Mulch shall be pulled back a minimum 50mm from the shrub or tree trunk and shall not bury any branches.

.4 Entire surface area of the excavated hole shall be covered with mulch.

.5 Thoroughly water mulch after it has been installed.

.6 Non-wood type mulches must be approved by Municipal Parks Department, prior to installation.

3.7 MAINTENANCE

.1 All shrub and tree beds shall be maintained weed free, with a well-defined edge.

.2 Remove weeds monthly.

.3 When herbicides or pesticides are utilized, they shall be applied in accordance with manufacturers' recommendation and shall be applied by a licensed pesticide applicator. Herbicides and pesticides shall be used in accordance with the Agricultural Chemicals Act and its regulations. Damage resulting from the Contractor's use of herbicides or pesticides will be repaired at the Contractor's expense.

.4 All plant material shall be watered individually. The Contractor shall be responsible for supplying and distributing any water for installation or maintenance purposes.

.5 Trees shall be watered at a rate of 1.2 liters per mm of caliper per week. Trees shall be watered to the point of saturation, do not over water trees. Trees may require more than one watering per week.

.6 Fertilizing:

.1 Apply 10-6-4 or similar fertilizer at rate of 18g / 25mm of caliper per tree, from trunk to dripline of tree.

.2 Apply 10-6-4 or similar fertilizer at rate of 5kg / 100m2 into upper surface of planting beds.

.3 Adjust composition and rate in accordance with soils report.

.4 Apply adequate watering after fertilizing to ensure penetration into root zone.

.7 If required to control insects, fungus, and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations.

.8 After planting, limit pruning to the removal of dead, broken, and/or diseased branches only.

.9 Pruning shall be undertaken in accordance with relevant sections in these Specifications.

.10 Replace or respread damaged, missing, or disturbed mulch.

.11 All accessories such as tree ties and stakes shall be maintained in good condition and repaired or replaced when required.

.12 The Contractor shall remove the tree stakes and ties after 1 year to prevent tree girdling.

.13 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.8 CLEANING

.1 Leave Work area clean and free of debris at end of each day.

.2 Waste Management: separate waste materials for reuse and recycling.

.1 Divert discarded burlap, wire and plastic plant containers and materials from landfill to plastic recycling facility approved by Owner's Representative.

.2 Dispose of unused fertilizer at official hazardous material collection site approved by Owner's Representative.

.3 Dispose of unused wood and mulch materials from landfill to recycling / composting facility approved by Owner's Representative.

3.9 CLOSEOUT ACTIVITIES

.1 Submit maintenance reports for trees, shrubs, and other plantings to Owner's Representative.

3.10 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Contractor: to be a Member in Good Standing of Landscape Alberta Nursery Trades Association (LANTA)

.2 Landscape Planting Supervisor: Canadian Nursery Landscape Association (CNLA) Certified Technician with Softscape Installation designation.

4 Measurement and Payment

.1 Payment for trees and shrubs shall be made at the unit price for each item as shown in the Bid Form, counted in place.

.2 Unit price for planting of trees shall include all costs for excavation and preparation of tree pits; supply and placement of trees, topsoil backfill and mulch; installation of all accessories; labour, equipment, and materials required to complete the work, and all incidentals necessary to complete the item in accordance with these Specifications.

.3 Unit price for planting of shrubs shall include all costs for supply and placement of shrubs within planting beds (described elsewhere in this Specification), labour, equipment and materials required to complete the work, and all incidentals necessary to complete the item in accordance with these Specifications.

.4 For planting of trees and shrubs, unit price shall include all costs to provide all necessary maintenance until acceptance by Owner's Representative, all labour, equipment and materials required to complete the work, and two (2) year warranty period.

.5 No separate payment will be made for the disposal of deleterious material off-site to a designated stockpile, or for any incidental necessary to complete this work item in accordance with these Specifications.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standard Institute (ANSI)

.1 ANSI A300 - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices.

.2 ANSI A300 - Tree, Shrub, and Other Woody Plant Maintenance - Standard Practices - Part 2 – Soil Management.

.3 ANSI A300 - Tree, Shrub and Other Woody Plant Maintenance: Standard Practices - Part 3 - Supplemental Support Systems

.2 Canadian Nursery Landscape Association

.3 International Society of Arboriculture

.4 Alberta Agriculture and Rural Development

.1 Pruning in Alberta.

.5 Definitions

.1 Crown Cleaning: consists of selective removal of one or more of following items: dead, dying, or diseased branches, weak branches, and water sprouts.

.2 Crown Thinning: consists of selective removal of branches to increase light penetration, air movement, and reduce weight.

.3 Crown Raising: consists of removal of lower tree branches to provide clearance.

.4 Crown Reduction or Crown Shaping: decreases tree height and/or spread.

.5 Vista Pruning: is selective thinning of framework limbs or specific crown areas to improve views.

.6 Crown Restoration: improves structure, form and appearance of trees that have been severely headed or vandalized.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with the Municipal solid waste bylaw and any other bylaws which may apply.

.2 Place materials defined as hazardous or toxic in designated containers and dispose in an environmentally approved location.

.3 Dispose of unused disinfectant to an environmentally approved location.

.4 Ensure emptied containers are sealed and stored safely.

.5 Divert wood materials from landfill to an environmentally approved location.

1.3 TOOL MAINTENANCE

.1 Ensure that tools are clean and sharp throughout pruning operation: do not use tools that crush or tear bark.

.2 Disinfect tools before each tree is pruned.

.3 On diseased plant material disinfect tools before each cut.

2 Products

2.1 DISINFECTANT

.1 20% solution of sodium hypochlorite or 70% solution of ethyl alcohol.

3 Execution

3.1 APPLICATION

.1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 GENERAL

.1 Prune in accordance with ANSI A300, and as directed by Owner's Representative. Where discrepancies occur between standard and these specifications, these specifications will govern.

.2 Notify immediately Owner's Representative of conditions detrimental to health of plant material or operations.

.3 Prune during plant dormant period or after leaves have matured. Avoid pruning during leaf formation, at time of leaf fall, or when seasonal temperature drops below minus 10 degrees C.

.4 Prune Birch and Populus sp. in late spring when in full leaf.

.5 Retain natural form and shape of plant species.

.6 Do not:

.1 Flush cut branches.

.2 Crush or tear bark.

.3 Cut behind branch bark ridge.

.4 Damage branch collars.

.5 Damage branches to remain.

3.3 PRUNING

.1 Remove dead, dying, diseased and weak growth as designated by Owner's Representative to promote healthy growth.

.2 Remove live branches that:

.1 Interfere with healthy development and structural strength including branches crossed or rubbing more important branches.

.2 Are of weak structure including narrow crotches.

.3 Obstruct development of more important branches.

.4 Are broken.

.3 Remove live branches to re-establish natural species form including:

.1 One or more developing leaders.

.2 Multiple growth due to previous topping.

.3 Branches extending outward from natural form.

.4 Undesirable sucker growth.

.4 Remove loose branches, twigs and other debris lodged in tree.

.5 Remove vines.

.6 For branches under 50 mm in diameter:

.1 Locate branch bark ridge and make cuts smooth and flush with outer edge of branch collar to ensure retention of branch collar. Cut target area to bottom of branch collar at angle equal to that formed by line opposite to branch bark ridge.

.2 Make cuts on dead branches smooth and flush with swollen callus collar. Do not injure or remove callus collar.

.3 Do not cut lead branches unless directed by Owner's Representative.

.7 For branches greater than 50 mm in diameter:

.1 Make first cut on lower side of branch 300 mm from trunk, one third diameter of branch.

.2 Make second cut on upper side of branch 500 mm from trunk until branch falls off.

.3 Make final cut adjacent to and outside branch collar.

.8 Ensure that trunk bark and branch collar are not damaged or torn during limb removal.

.1 Repair areas which are damaged or remove damaged area back to next branch collar.

.9 Remove additional growth designated by Owner's Representative.

3.4 ROOT GIRDLING

.1 For girdling roots one-quarter size of trunk diameter or larger, V-cut girdling root one-half way through at point where root is crossing.

.2 Remove exposed portion of girdling root as directed by Owner's Representative after cleanly cutting root flush with grade on each side of parent root. Do not injure bark or parent root.

3.5 CARE OF WOUNDS

.1 Shape bark around wound to oblong configuration ensuring minimal increase in wound size. Retain peninsulas of existing live bark.

3.6 CLEAN UP

.1 Collect and recycle / compost pruned material whenever applicable.

3.7 QUALITY ASSURANCE

.1 Certification: provide Canadian Nursery Landscape Association certification to Owner's Representative.

.2 Regulatory requirements: provide safety certificate as approved by local power utility to Owner's Representative.

.3 Field Samples: do sample pruning in manner to enable Owner's Representative to identify:

.1 Knowledge of target areas including branch bark ridge and branch collars.

.2 Technique for selection process and pruning used to establish desired form and shape for each species.

.4 Acceptance of Work will be determined by Owner's Representative from field sample.

4 Measurement and Payment

.1 No separate payment shall be made under this Section. Payment for the work specified and all labour, equipment, and materials required to complete the work shall be included in related sections.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Materials and installation for fertilizing and preserving root systems of plants affected by changing grades or excavation.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA G30.5, Welded Steel Wire Fabric for Concrete Reinforcement.

.2 Department of Justice Canada

.1 Canadian Environmental Protection Act (CEPA), c. 33.

.2 Fertilizers Act (c, F-10).

.3 Fertilizers Regulations (C.R.C., c. 666).

.4 Transportation of Dangerous Goods Act (TDGA), c. 34.

.3 Health Canada – Pest Management Regulatory Agency (PRMA).

.1 National Standard for Pesticide Education, Training and Certification in Canada.

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

1.3 DEFINITIONS

.1 Mychorrhiza: association between fungus and roots of plants. This symbiosis enhances plant establishment in newly landscaped and imported soils.

1.4 SUBMITTALS

.1 Make submittals in accordance with Section 1 04 00 – Submittal Procedures.

.2 Submit monthly written reports on maintenance during warranty period, to Owner's Representative identifying:

.1 Maintenance work carried out.

.2 Development and condition of plant material.

.3 Preventative or corrective measures required which are outside Contractor's responsibility.

.4 Submit WHMIS MSDS to Owner's Representative.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Remove from site and dispose of packaging materials at environmentally approved facilities.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Owner's Representative.

.4 Divert unused wood materials from landfill by composting or mulching as approve by Owner's Representative.

.5 Place materials designated as hazardous or toxic in designated containers and dispose at an environmentally approved facility.

.6 Dispose of unused fertilizer material at official hazardous material collections site as approved by Owner's Representative.

.7 Handle and dispose of hazardous materials in accordance with CEPA and Municipal regulations.

.8 Do not dispose of unused fertilizer material into sewer system, into streams, lakes, onto ground or in any other location where they will pose health or environmental hazard.

.9 Ensure emptied containers are sealed and stored safely.

1.6 SCHEDULING

.1 Obtain approval from Owner's Representative of schedule indicating beginning of Work.

1.7 MAINTENANCE DURING WARRANTY PERIOD

.1 From time of acceptance by Owner's Representative to end of two-year warranty period, perform following maintenance operations:

.1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.

.2 Apply pesticides in accordance with National Standard for Pesticide Education, Training and Certification in Canada, Federal, Provincial and Municipal regulations as and when required to control insects, fungus, and disease. Obtain product approval from Owner's Representative prior to application.

.3 Apply fertilizer in early spring at a rate of 0.025kg of nitrogen / m^2 of affected area.

.4 Remove dead, broken or hazardous branches from plant material. Dispose of debris through composting or mulching.

2 Materials

2.1 #1 TOPSOIL MIX

.1 In accordance with Section 4 01 40 - Topsoil Placement and Grading.

2.2 FERTILIZER

.1 To Canada Fertilizer Act and Fertilizer Regulations.

.2 Complete, commercial, slow release with 35% of nitrogen content in water-insoluble form.

2.3 ANTI-DESSICANT

.1 Commercial, wax like emulsion.

2.4 HOARDING

.1 Wood posts: 89 x 89 x 2400mm length, untreated wood.

.2 Wood bracing: 38 x 89 x 2400mm length, untreated wood.

.3 Plywood: 19mm thick sheet material, untreated.

.4 Snow fencing: 38 x 38mm mesh x 2400mm high, orange plastic.

.5 T-bar: steel, 40 x 40 x 5mm, length to suit.

.6 Welded wire fabric (WWF): 100 x 100mm, to CSA G30.5.

3 Execution

3.1 IDENTIFICATION AND PROTECTION

.1 Identify plants and limits of root systems to be preserved as approved by the Owner's Representative.

.2 Protect tree roots from compaction and contamination resulting from construction as approved by the Owner's Representative.

.1 The Owner's Representative shall identify a Tree Protection Zone (TPZ) that shall be barricaded to the satisfaction of the Owner's Representative. Generally, the TPZ shall not be less than the drip line of the tree and extend outward 450mm for every 25mm of trunk caliper. The final extent of the TPZ shall be to the satisfaction of the Owner's Representative.

.2 No equipment, storing of materials or dumping of chemicals is allowed within the TPZ unless directed by the Owner's Representative.

.3 Existing grade within the TPZ shall not be raised or lowered unless directed by the Owner's Representative.

.4 No pruning is to be done inside the TPZ unless directed by the Owner's Representative.

3.2 EXCAVATIONS NEAR TREES

.1 Identify limits for required construction excavation as approved by the Owner's Representative.

.2 The Owner's Representative shall be present during excavation operations.

.3 Excavations within 2.0m of trees:

.1 Prior to construction excavation, tree roots to be severed with a trencher to a depth of 750mm.

.4 Excavations beyond 2.0m of trees:

.1 Trenching not required. Immediately after excavation, prune all tree roots.

.5 Prune exposed roots cleanly at side of trench nearest plants to be preserved. Pruned ends to point obliquely downwards.

.6 Place a tarpaulin over excavation wall to prevent exposed roots from drying out.

.7 Backfill around tree roots as soon as possible, with soil mix of 3 parts topsoil, 1 part sand and 1 part peat.

.8 Erect hoarding as follows:

.1 For excavations within 3-5 metres of identified trees: snow fence at farthest distance from trees.

.2 For excavations within 1-3 metres of identified trees: plywood barrier at farthest distance from trees.

.3 For excavations within 1 metre of identified trees: 89 x 89mm wood posts bound with strapping.

.9 Remove hoarding only at the direction of the Owner's Representative.

3.3 PRUNING

.1 Prune in accordance with Section 4 03 10 – Tree Pruning.

.2 Prune crown to compensate for root loss while maintaining general form and character of plant. Dispose of debris through composting or mulching.

3.4 ANTI-DESICCANT

.1 Apply anti-desiccant to foliage where applicable and as directed by Owner's Representative.

4 Measurement and Payment

.1 There will be no separate payment made for Tree and Shrub Preservation.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Supply and installation of mulch in softscape areas.

1.2 REFERENCES

.1 Health Canada / Workplace Hazardous Materials Information Systems (WHMIS)

.1 Material Safety Data Sheets (MSDS)

1.3 ACTION AND SUBMITTALS

.1 Submit in accordance with Section 1 04 00 – Submittal Procedures

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for fertilizer and include product characteristics, performance criteria, physical size, finish, and limitations to Owner’s Representative.

.2 Submit WHMIS MSDS to Owner’s Representative.

.3 Samples:

.1 Submit 0.5kg container of each type of fertilizer used to Owner’s Representative for approval.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer’s written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer’s name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with supplier’s recommendations.

.2 Replace defective or damaged materials with new.

.4 Packaging Waste Management:

.1 Collect and separate materials for disposal and recycling at an environmentally approved location.

.2 Dispose / recycle materials at appropriate facilities at an environmentally approved location.

1.5 TESTING

.1 Perform soil tests when directed by Owner's Representative to verify fertilizer applications and the results of corrective measures taken to improve soil condition as recommended in the soil test reports.

.2 Use soil moisture meter or probe to test and measure availability of moisture in turf and plant soil areas. Test monthly and record in log. Log to be reviewed by Owner's Representative when requested.

1.6 MAINTENANCE PERIOD

.1 Unless otherwise specified, the Contractor shall be responsible for regular weekly maintenance of all landscaped areas for a period of one (1) year from the date of Substantial Performance.

.2 If the warranty responsibilities of the Contractor are extended, the maintenance period shall be extended until these warranty responsibilities are met.

2 Products

2.1 TOPSOIL

.1 In accordance with Section 4 01 40 - Topsoil Placement and Finish Grading.

2.2 FERTILIZER

.1 To Canada "Fertilizers Act" and Fertilizers Regulations.

.1 Complete, synthetic, slow release with 65% nitrogen content in water soluble form.

.2 Specific N-P-K formulation as determined by soil test.

2.3 WATER

.1 Free of impurities that would inhibit germination and growth.

.2 Supplied as per Section 1 09 00 - Temporary Utilities. Contractor to supply all related hoses, trucks, sprinklers as required at no cost to the Owner.

2.4 PLANTING ACCESSORIES

.1 Stakes, guy wire, tree trunk protection and other accessories as needed in accordance with Section 4 03 00 - Trees, Shrubs and Ground Covers.

3 Execution

.1 The Contractor is responsible to monitor the site and advise Owner's Representative of conditions that might void the Contractor's warranty responsibilities.

.2 Contractor shall maintain a log noting:

.1 Current site conditions, including moisture levels.

.2 Development and conditions of plant material.

.3 Times, dates, maintenance performed.

.4 Preventative or corrective measures required which are outside Contractor's responsibility.

.3 The maintenance log shall be in a form acceptable to Owner's Representative.

.4 The Contractor shall notify Owner's Representative of the exact time the Contractor proposes to commence each application.

.5 The Contractor shall forward the updated maintenance log to Owner's Representative within 24 hours of each maintenance application.

3.2 SPRING CLEANUP

.1 Maintenance period will commence on May 1 or on such date as mutually agreed upon by the Contractor and Owner's Representative.

.2 Complete spring clean-up as soon as working conditions are favourable.

.3 Remove and dispose of protective coverings and mulch used in winter protection and dispose at an environmentally approved location.

.4 Clean, collect and remove sand, gravel and debris accumulated during winter months from maintained turf and paved areas. Dispose in approved Municipal disposal site.

.5 Remove and store off site: snow fencing, stakes and sand containers.

.6 Rake, clean and remove all dead vegetation, leaves, debris and snow mould from turf areas.

.7 Roll turf areas lightly where grass has lifted due to frost action.

.8 Clean planting beds and planters of debris and dead plant material and remove from site. Loosen and lightly cultivate soil without disturbing roots and permanent plants.

3.3 TREE AND SHRUB MAINTENANCE

.1 Perform the following maintenance operations:

.1 Remove weeds monthly.

.2 Replace or re-spread damaged, missing, or disturbed mulch.

.3 For non-mulched areas, cultivate as required to keep top layer of soil friable.

.4 Maintain watering saucers around perimeter of planting pit. At the completion of the maintenance period remove saucers and blend into adjacent grade.

.5 Supply and add soil amendments according to soil analysis.

.6 Add topsoil as necessary where settlement has occurred.

.7 Fertilizing:

.1 Apply 10-6-4 or similar fertilizer at rate of 18g / 25mm of caliper per tree, from trunk to dripline of tree.

.2 Apply 10-6-4 or similar fertilizer at rate of 5kg / 100m^2 into upper surface of planting beds.

.3 Adjust composition and rate in accordance with soils report.

.4 Apply adequate watering after fertilizing to ensure penetration into root zone.

.8 If required to control insects, fungus, and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations.

.9 Remove dead of broken branches from plant material.

.10 Prune in accordance with Section 4 03 10 - Tree Pruning.

.11 Keep stakes, guy wires and trunk protection in proper repair and adjustment. Remove stakes and accessories when tree has become self supporting or as directed by Owner's Representative.

.12 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings in Section 4 03 00 – Trees, Shrubs and Ground Covers.

3.4 SODDED AND SEEDED AREA MAINTENANCE

.1 Perform following maintenance operations:

.1 Water sodded areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.

.2 Repair dead or bare spots to satisfaction of Owner's Representative.

.3 Cut grass and remove clippings that will smother grass as directed by Owner's Representative to height as follows:

.1 50 mm during normal growing conditions.

.2 Cut grass at 2-week intervals or as directed by Owner's Representative, but at intervals so that approximately 1/3 of growth is removed in single cut.

.4 Fertilizing:

.1 Apply 27-14-0 at a rate of 3kg / 100m2. Adjust composition and rate in accordance with soils report. Fertilize with commercial fertilizer a minimum 3 times during the growing season.

.2 Use only mechanical equipment, checking calibration of spreader to ensure specified rate is used.

.3 Spread 50% fertilizer in one direction, 50% at right angles.

.4 Water immediately after fertilizing, according to manufacturer's recommendations. Obtain moisture penetration to 50mm minimum depth.

.5 Eliminate weeds by mechanical or chemical means to extent acceptable to Owner's Representative.

.6 If chemical means are used, comply with all National, Provincial and Municipal regulations and Codes of Practices.

3.5 AUTUMN PREPARATION

.1 Deep water trees and shrubs prior to freeze-up. Continue deep watering plants where unseasonably warm dry temperatures are experiences.

.2 Protect plants from rodent, animal, and sun damage by use of appropriate materials. Use chemical repellent, rodent wire mesh, plastic perforated strip, burlap, or other approved material.

3.6 CLOSEOUT

.1 Submit maintenance reports for trees, shrubs, and other plantings to Owner's Representative.

3.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Maintenance Supervisor: "Landscape Industry Certified" Technician with Softscape Installation Specialization as regulated by Canadian Nursery Landscape Association (CNLA).

4 Measurement and Payment

.1 No separate payment will be made for work specified in this Section.

END OF SECTION