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## **PART 1 - GENERAL**

### **1.1 DESCRIPTION**

- .1 In general, the work under this contract consists of, but will not necessarily be limited to, the following:
  - .1 All traffic control required to complete the work.
  - .2 The protection of all features designated to remain.
  - .3 Excavation of all required common material and rock required to complete the work indicated.
  - .4 Removal of existing paint markings as well as application of new paint markings as indicated.
  - .5 Installation of new traffic signage as indicated.
  - .6 Site grading as indicated.
  - .7 Construction of crusher dust paths, new asphalt and gravel entry road as indicated.
  - .8 Supply and installation of new pavement markings and site signage as indicated.
  - .9 Supply and installation of submersible pumping station and all accompanying fittings and parts as indicated.
  - .10 Supply and installation of sanitary gravity sewer, sanitary force main, water services, and storm culvert.
  - .11 Drilling and installation of domestic water well.
  - .12 Supply and installation of underground conduit and accompanying electrical infrastructure.

### **1.2 IMPLEMENTATION**

- .1 This contract shall be planned and implemented by the Contractor, such that all work is carried out within the specified time frame. All measures necessary to meet this deadline including, but not limited to, phasing and cold weather concreting, shall be considered when bidding for this project.

### **1.3 SITE OF WORK**

- .1 Work will be carried out at the entrance to the Cavendish Beach campground, in Cavendish, PEI, in the locations as shown on the accompanying drawings.

### **1.4 DATUM**

- .1 Datum used for this project is as shown on the drawings.
-

## **1.5 FAMILIARIZATION WITH SITE**

- .1 Before submitting a bid, it is recommended that bidders visit the site and its surroundings to review and verify the form, nature and extent of the work, materials necessary for the completion of the works, the means of access to the site, severity, exposure and uncertainty of weather, soil conditions, any accommodations they may require, and in general shall obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their bid. No allowance shall be made subsequently in this connection on account of error or negligence to properly observe and determine the conditions that will apply. A non-mandatory site tour will be scheduled during the tender period.

## **1.6 CODES AND STANDARDS**

- .1 Perform work in accordance with the following codes and legislative requirements:
    - .1 Environment Act of the Province of Prince Edward Island.
    - .2 Environmental Control (Water and Sewer) Regulations of the Province of Prince Edward Island.
    - .3 Waste Material Disposal Act of the Province of Prince Edward Island.
    - .4 Canadian Environmental Protection Act.
    - .5 Transportation Dangerous Goods Act.
    - .6 Canadian Fisheries Act.
    - .7 Canadian Council of Ministers of the Environment (CCME). National Guidelines for Decommissioning Industrial Sites.
    - .8 Canada Labour Code Occupational Health and Safety Standards.
    - .9 National Building Code of Canada, latest edition.
    - .10 National Fire Code of Canada, latest edition.
    - .11 Prince Edward Island Occupational Health and Safety Act and Regulations.
    - .12 The Storage and Handling of Gasoline and Associated Products Regulations by the Province of Prince Edward Island.
    - .13 Any other Federal, Provincial, Municipal and Local Code, Standard, Regulation, Guideline, By-Law or Ordinance having jurisdiction.
  - 2 Materials and workmanship must meet or exceed requirements of specified Standards, codes and referenced documents.
-

## **1.7 SETTING OUT WORK**

- .1 Employ a qualified registered land surveyor, licensed to practice in Prince Edward Island, to mark out services and utilities, set grades and layout work in detail from control points and grades specified on the drawings.
- .2 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated or as directed by Departmental Representative.
- .3 Provide devices needed to layout and construct work.
- .4 Supply stakes and other survey markers required for laying out work.

## **1.8 COST BREAKDOWN**

- .1 Before submitting first progress claim, submit breakdown of Contract price in detail as directed by Departmental Representative and aggregating contract price.
- .2 Provide cost breakdown divided into major work components as directed by Departmental Representative.
- .3 Upon approval by Departmental Representative, cost breakdown will be used as basis for progress payment.
- .4 All work items and costs are to be included in the lump sum price.

## **1.9 WORK SCHEDULE**

- .1 Submit within five (5) working days of notification of acceptance of bid, a Construction schedule showing commencement and completion of all work within the time stated on the bid and acceptance form and the date stated in the bid acceptance letter.
-

- 2 Provide sufficient details in schedule to clearly illustrate entire implementation plan, depicting efficient coordination of tasks and resources, to achieve completion of work on time and permit effective monitoring of work progress in relation to established milestones.
- 3 As a minimum, work schedule to be prepared and submitted in the form of bar (GANTT) charts, indicating work activities, tasks and other project elements, their anticipated durations and planned dates for achieving key activities and major project milestones provided in sufficient details and supported by narratives to demonstrate a reasonable plan for completion of project within designated time (e.g., show target dates for completion of each work item, if applicable). Breakdown elements to indicate target dates for completion of each element. Generally, bar charts derived from commercially available computerized project management systems are preferred but not mandatory.
- 4 Submit schedule updates on an as-required basis and when requested by Departmental Representative. Provide a narrative explanation of necessary changes and schedule revisions at each update.
- 5 The schedule, including all updates, shall be to the Departmental Representative's approval. Take necessary measures to complete work within approved time. Do not change schedule without Departmental Representative's approval.
- 6 All work on the project will be completed within the time indicated on the Bid and Acceptance Form.

### **1.10 ABBREVIATIONS**

- 1 Following abbreviations of standard specifications have been used in this specification and on the drawings:
    - 1 CGSB - Canadian Government Specifications Board
    - 2 CSA - Canadian Standards Association
    - 3 ASTM - American Society for Testing and Materials DR - Departmental Representative
  - 2 Where these abbreviations and standards are used in this project, latest edition in effect on date of bid call will be considered applicable.
-

### **1.11 QUARRY AND EXPLOSIVES**

- 1 Make own arrangements with Provincial Authorities and Crowns of properties, for the quarrying and transportation of rock and all materials and machinery necessary for work over their property, roads or streets as case may be.

### **1.12 SITE OPERATIONS**

- 1 Arrange for sufficient space adjacent within project site for conduct of operations, storage of materials, etc. Exercise care so as not to obstruct or damage public or private property in area. Do not interfere with normal day-to-day operations in progress at site. All arrangements for space and access will be made by Contractor.
- 2 Remove snow and ice as required to maintain safe access in a manner that does not damage existing structures or interfere with the operations of others.

### **1.13 PROJECT MEETINGS**

- 1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording minutes.
- 2 Project meetings will take place on site of work unless so directed by Departmental Representative.
- 3 Departmental Representative will assume responsibility for recording minutes of meetings and forwarding copies to all parties present at meetings.
- 4 Have a responsible member of firm present at all Project Meetings.

### **1.14 PROTECTION**

- 1 Store all materials and equipment to be incorporated into work to prevent damage by any means.
  - 2 Repair and replace all materials or equipment damaged in transit or storage to the satisfaction of the Departmental Representative and at no cost to the Departmental Representative.
-

### **1.15 EXISTING SERVICES**

- .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by governing authorities, with minimum of disturbance to site operations, pedestrian, vehicular traffic, and tenant operations.
- .2 Before commencing work, establish locations and extent of service lines in area of work and notify Departmental Representative of findings.
- .3 Submit schedule to and obtain approval from Departmental Representative for any shutdown or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .4 Provide temporary services to maintain critical facility systems.
- .5 Provide adequate bridging over trenches which cross walkways or roads to permit normal traffic.
- .6 Where unknown services or conditions are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .7 Protect, relocate or maintain existing active services as required. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction over service. Record locations of maintained, re-routed and abandoned service lines.

### **1.16 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one (1) copy each of the following:
  - .1 Contract drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed shop drawings.
  - .5 List of outstanding shop drawings.
  - .6 Change Orders.
  - .7 Other modifications to contract.
  - .8 Field test reports.
  - .9 Copy of approved work schedule.
  - .10 Site specific Health and Safety Plan and other safety related documents.
  - .11 Permits and Regulatory Approvals and Requirements.
  - .12 Other documents as stipulated elsewhere in the Contract Documents.

**1.17 PERMITS**

- 1 Obtain and pay for all permits, certificates, and licenses as required by Municipal, Provincial, Federal and other authorities.
- 2 Provide appropriate notifications of project to Municipal and Provincial inspection authorities.
- 3 Obtain compliance certificates as prescribed by legislative and regulatory provisions of municipal, provincial and federal authorities as applicable to the performance of work.
- 4 Submit to Departmental Representative, copy of application submissions and approval documents received for above referenced authorities.
- 5 Submit to Departmental Representative, copy of quarry permit, if applicable, prior to start of quarry operations.
- 6 Comply with all requirements, recommendations and advice by all regulatory authorities unless otherwise agreed in writing by Departmental Representative. Make requests for such deviations to these requirements sufficiently in advance of related work.

**1.18 CUTTING, FITTING AND PATCHING**

- 1 Execute cutting, including excavation, fitting and patching required to make work fit properly.
  - 2 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work. This includes patching of openings in existing work resulting from removal of existing services.
  - 3 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
-

### **1.19 LOCATION OF EQUIPMENT**

1. Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
2. Inform Departmental Representative when impending installation conflicts with other new or existing components. Follow directives for actual location.
3. Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

### **1.20 ACCEPTANCE**

1. Prior to the issuance of the Certificate of Substantial Performance, in company with Departmental Representative, make a check of all work. Correct all discrepancies before final inspection and acceptance.

### **1.21 WORKS COORDINATION**

1. Contractor to be responsible for coordinating the work of the various trades, where the work of such trades interfaces with each other.
2. Convene meetings between trades whose work interfaces and ensure that they are fully aware of the areas and the extent of where interfacing is required. Provide each trade with the plans and specifications of the interfacing trade, as required, to assist them in planning and carrying out their respective work.
3. The Departmental Representative will not be responsible for or held accountable for any extra costs incurred as a result of the failure to carry out coordination work. Disputes between the various trades as a result of their not being informed of the areas and extent of interface work shall be the sole responsibility of the General Contractor and shall be resolved at no extra cost to the Departmental Representative.

### **1.22 CONTRACTOR'S USE OF SITE**

1. Construction operations, including storage of materials, for this contract not to interfere with the operations at this facility.
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- 2 Contractor responsible for arranging the storage of materials on or off site and any materials stored at the site which interfere with any of the day-to-day activities at or near the site will be moved promptly at the Contractor's expense, upon request by the Departmental Representative.
- 3 Contractor will take adequate precautions to protect existing structures when operating tracked equipment.
- 4 Exercise care so as not to obstruct or damage public or private property in the area.
- 5 At completion of work, restore area to its original condition. Damage to ground and property will be repaired by Contractor. Remove all construction materials, residue, excess, etc., and leave site in a condition acceptable to Departmental Representative.

### **1.23 WORK BY OTHERS**

- 1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- 2 Coordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.

### **1.24 WORK COMMENCEMENT**

- 1 Mobilization to project site is to commence immediately after acceptance of bid and submission of site specific Safety Plan and insurance documentation, unless otherwise agreed by Departmental Representative.
  - 2 Project work on site is to commence as soon as possible with a continuous reasonable workforce unless otherwise agreed by Departmental Representative.
  - 3 Weather conditions, short construction season, delivery challenges and the location of the work site may require the use of longer working days and additional workforce to complete the project within the specified completion time.
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- 4 Make every effort to ensure that sufficient material and equipment is delivered to site at the earliest possible date after acceptance of bid and replenished as required.

**1.25 FACILITY SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions.

**1.26 INTERPRETATION OF DOCUMENTS**

- .1 Supplementary to the General Conditions, the Division 01 sections of the specifications take precedence over technical specification in other divisions of the specifications.

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.

### **1.2 ACCESS AND EGRESS**

- .1 Design, construct and maintain temporary “access to” and “egress from” work areas, including ramps independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

### **1.3 USE OF SITE AND FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to buildings and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Closures: protect work temporarily until permanent enclosures are completed.

### **1.4 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

### **1.5 EXISTING SERVICES**

- .1 Extreme caution is to be taken during excavation so as not to damage existing buried utilities in any way. Any damage shall be repaired by the Contractor, at no additional cost to the Departmental Representative. Excavation operations shall be coordinated with the Departmental Representative.

### **1.6 SPECIAL REQUIREMENTS**

- .1 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.
-

- 2 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

### **1.7 SECURITY CLEARANCES**

- 1 Personnel employed on this project will be subject to a security check. Obtain clearance, as instructed, for each individual who will require to enter premises.
- 2 Personnel will be checked daily at start of work shift and provided with a pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.

### **PART 2 - PRODUCTS**

Not applicable

### **PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE**

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory are specified under various sections. The testing laboratory shall be certified by the Canadian Council of Independent Laboratories (CCIL) in accordance with CSA Standard A283.06, and shall require prior approval of the Departmental Representative.

### **1.2 APPOINTMENT AND PAYMENT**

- .1 Contractor will appoint and pay for services of testing laboratory for the following:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing performed exclusively for Contractor's convenience.
  - .3 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.
  - .4 Tests requested by Departmental Representative to confirm material specifications when the applicable manufacturer's documentation or test results are unavailable.
  - .5 Additional tests specified in paragraph 1.2.2.
- .2 Where test or inspections by designated testing laboratory reveal work not in accordance with contract requirements, Contractor shall pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.
- .3 Contractor to arrange and pay for geotechnical materials testing including:
  - .1 Verification of Subgrade.
  - .2 Compaction and laboratory testing of gravel and asphalt structure.
  - .3 Concrete field and laboratory testing.

### **1.3 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.
    - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
-

- 2 Notify Departmental Representative sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- 3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- 4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 DEFINITIONS**

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
  
  - 2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
  
  - 3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
  
  - 4 Construction Work Week: Monday to Friday, inclusive, will provide five (5) day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
  
  - 5 Duration: number of work periods (not including holidays or other non-working periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
  
  - 6 Master Plan: summary-level schedule that identifies major activities and key milestones.
  
  - 7 Milestone: significant event in project, usually completion of major deliverable.
  
  - 8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
  
  - 9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.
-

## **1.2 REQUIREMENTS**

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- 2 Plan to complete work in accordance with prescribed milestones and time frame.
- 3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- 4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

## **1.3 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- 2 Submit to Departmental Representative, within 10 days of Award of Contract, Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- 3 Submit Project Schedule to Departmental Representative within five (5) working days of receipt of acceptance of Master Plan.
- 4 Should contractor want to work weekends/holidays, a written request must be submitted to the Departmental Representative at least 2 days in advance to allow for scheduling of on-site department representative personnel.

## **1.4 PROJECT MILESTONES**

- .1 This contract shall be planned and implemented by the Contractor, such that all work is carried out and completed within the specified time frame. All measures necessary to meet this deadline shall be considered as indicated when bidding this project.
-

## **1.5 MASTER PLAN**

- .1 Structure schedule to allow orderly planning, organizing and execution of work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules with five (5) working days.
- .3 Revise impractical schedule and resubmit within five (5) working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

## **1.6 PROJECT SCHEDULE**

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
  - .1 Award.
  - .2 Shop Drawings.
  - .3 Permits.
  - .4 Mobilization.
  - .5 Excavation.
  - .6 Buried infrastructure installation.
  - .7 Connections to existing infrastructure.
  - .8 Testing and Commissioning.
  - .9 Restoration.

## **1.7 PROJECT SCHEDULE REPORTING**

- .1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.
  - .2 Include as part of Project Schedule, narrative report identifying work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.
-

## **1.8 PROJECT MEETINGS**

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
  
- 2 Weather related delays with their remedial measures will be discussed and negotiated.

## **PART 2 - PRODUCTS**

Not applicable

## **PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 SUBMITTAL GENERAL REQUIREMENTS**

- .1 Submit to Departmental Representative for review submittals listed, including shop drawings, samples, certificates and other data, as specified in other sections of the Specifications.
  - .2 Submit with reasonable promptness and in orderly sequence so as to allow for Departmental Representative's review and not cause delay in Work. Failure to submit in ample time will not be considered sufficient reason for an extension of Contract time and no claim for extension by reason of such default will be allowed.
  - .3 Do not proceed with work until relevant submissions are reviewed by Departmental Representative.
  - .4 Present shop drawings, product data and samples in SI Metric units.
  - .5 Where items or information is not produced in SI Metric units, provide soft converted values.
  - .6 Review submittals prior to submission to Departmental Representative. Ensure during review that necessary requirements have been determined and verified, required field measurements or data have been taken, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents.
    - .1 Submittals not stamped, signed, dated and identified as to specific project will be returned unexamined by Departmental Representative and considered rejected.
  - .7 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
  - .8 Verify field measurements and affected adjacent work and coordinate.
  - .9 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
-

- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative's review.
- .11 Submittal format: electronic copies, or alternatively paper originals or clear and fully legible photocopies of originals. Facsimiles are not acceptable, except in special circumstances pre-approved by Departmental Representative. Poorly printed non-legible copies will not be accepted and be returned for resubmission.
- .12 Make changes or revisions to submissions which Departmental Representative may require, consistent with Contract Documents and resubmit as directed by Departmental Representative. When resubmitting, notify Departmental Representative in writing of any revisions other than those requested.
- .13 Keep one reviewed copy of each submittal document on site for duration of Work.

## **1.2 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 Contractor to illustrate details of a portion of Work that are specific to project requirements.
  - 2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, 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 Section under which adjacent items will be supplied and installed.
  - 3 Allow five (5) working days for Departmental Representative's review of each submission.
  - 4 Accompany submissions with transmittal letter containing:
    - .1 Date.
    - .2 Project title and number.
    - .3 Contractor's name and address.
    - .4 Identification and quantity of each shop drawing, product data and sample.
    - .5 Other pertinent data.
-

- 5 Submissions include:
    - .1 Date and revision dates.
    - 2 Project title and number.
    - 3 Name and address of:
      - .1 Subcontractor.
      - 2 Supplier.
      - 3 Manufacturer.
    - 4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
    - 5 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.
  - 6 After Departmental Representative's review, distribute copies.
  - 7 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
  - 8 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
  - 9 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
    - 2 Testing must have been within 3 years of date of contract award for project.
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- .10 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
    - .2 Certificates must be dated after award of project contract complete with project name.
  
  - .11 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
  
  - .12 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
  
  - .13 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
  
  - .14 Delete information not applicable to project.
  
  - .15 Supplement standard information to provide details applicable to project.
  
  - .16 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, transparency copies 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 same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
  
  - .17 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
    - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for
-

meeting requirements of construction and Contract Documents.

- 2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

#### **14 SCHEDULES, PERMITS AND CERTIFICATES**

- .1 Upon acceptance of bid, submit to Departmental Representative copy of Work Schedule and various other schedules, permits, certification documents and project management plans as specified in other sections of the Specifications.
- 2 Submit copy of permits, notices, compliance Certificates received from Regulatory Agencies having jurisdiction and as applicable to the Work.
- 3 Submission of above documents to be in accordance with Submittal General Requirements procedures specified in this section.

#### **PART 2 - PRODUCTS**

Not applicable

#### **PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 This section specifies operational requirements and traffic control when roadway traffic is to be accommodated during construction.

### **1.2 REFERENCES**

- .1 Prince Edward Island Ministry of Transportation and Infrastructure Renewal
  - .1 Temporary Workplace Traffic Control Manual – Latest Version with Updates.
- 2 Transportation Association of Canada (TAC)
  - 2 Manual of Uniform Traffic Control Devices. (MUTCD) – Latest Version with Updates.

### **1.3 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 minimize interference and hazard to travelling public.
    - 2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
    - 3 Do not leave equipment on travelled way overnight.
  - 3 Close lanes of road only after receipt of written approval from Departmental Representative.
    - .1 Before re-routing traffic erect suitable signs and devices to Temporary Workplace Traffic Control Manual.
  - 4 Keep travelled way graded, free from pot holes and of sufficient width for required number of lanes of traffic.
    - .1 Provide 6 m wide minimum temporary roadway for traffic in two-way sections through Work and on detours.
    - 2 Provide 4 m wide minimum temporary roadway for traffic in one-way sections through Work and on detours.
  - 5 Provide graveled detours or temporary roads as indicated, or as directed by Departmental Representative to facilitate passage of traffic around restricted
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construction area:

- .1 Place and compact granular sub-base in accordance with Section 32 11 16.01 - Granular Sub-base.
- 2 Place and compact granular base in accordance with Section 32 11 23 - Aggregate Base Courses.
  
- .6 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, except where other means of road access exist that meet approval of Departmental Representative.

#### **14 INFORMATIONAL AND WARNING DEVICES**

- .1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.
- 2 Supply and erect signs, delineators, barricades and miscellaneous warning devices to Manual of Uniform Traffic Control Devices and Temporary Workplace Traffic Control Manual.
- 3 Place signs and other devices in locations recommended in Manual of Uniform Traffic Control Devices and Temporary Workplace Traffic Control Manual.
- 4 Meet with Departmental Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Departmental Representative.
- 5 Continually maintain traffic control devices in use:
  - .1 Check signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
  - 2 Remove or cover signs which do not apply to conditions existing from day to day.

#### **15 CONTROL OF PUBLIC TRAFFIC**

- .1 Provide competent flag personnel, trained in accordance with, and properly equipped to Manual of Uniform Traffic Control Devices and Temporary Workplace Traffic Control Manual for situations as follows:
    - .1 When public traffic is required to pass working vehicles or equipment that 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 not readily available.
  - 6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
  - 7 At each end of restricted sections where pilot cars are required.
  - 8 Delays to public traffic due to contractor's operators: 15 minutes maximum.
- 
- 2 Where roadway, carrying two-way traffic, is restricted to one lane, for 24 hours each day, provide portable traffic signal system.
    - 1 Adjust, as necessary, and regularly maintain system during period of restriction.
    - 2 Ensure signal system meets requirements of Manual of Uniform Traffic Control Devices and Temporary Workplace Traffic Control Manual.

## **1.6 OPERATIONAL REQUIREMENTS**

- 1 Maintain existing conditions for traffic throughout period of contract except that, when required for construction under contract and when measures have been taken as specified and approved by Departmental Representative to protect and control public traffic.
- 2 Maintain existing conditions for traffic crossing right-of-way.

## **PART 2 - PRODUCTS**

Not applicable.

## **PART 3 - EXECUTION**

Not applicable.

END

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## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Fire Safety Requirements

### **1.2 RELATED WORK**

- .1 Section 01 35 29.06 - Health and Safety Requirements

### **1.3 REFERENCES**

- .1 Fire Protection Standards issued by Fire Protection Services of Human Resources Development Canada as follows:
  - .1 FCC No. 301-June 1982 Standard for Construction Operations ([http://www.hrsdc.gc.ca/eng/labour/fire\\_protection/policies\\_standards/commissioner/301/page00.shtml](http://www.hrsdc.gc.ca/eng/labour/fire_protection/policies_standards/commissioner/301/page00.shtml)).
  - .2 FCC standards, may also be viewed at the Regional Fire Protection Services' office (previously known as the Fire Commissioner of Canada) located at 99 Wyse Road, 8th Floor, Dartmouth, NS, Tel: (902) 426-6053.

### **1.4 SUBMITTALS**

- .1 Submit in accordance with the Submittal General Requirements specified in Section 01 33 00.

### **1.5 FIRE SAFETY REQUIREMENTS**

- .1 Implement and follow fire safety measures during work. Comply with following:
    - .1 National Fire Code, latest edition
    - .2 Fire Protection Standards FCC 301 and FCC 302.
    - .3 Federal and Provincial Occupational Health and Safety Acts and Regulations as specified in section 01 35 29.06.
  - .2 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.
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**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 35 24: Special Procedures on Fire Safety Requirements.

### **1.2 DEFINITIONS**

- .1 COSH: Canada Occupational Health and Safety Regulations made under Part II of the Canada Labour Code.
- 2 Competent Person: means a person who is:
  - .1 Qualified by virtue of personal knowledge, training and experience to perform assigned work in a manner that will ensure the health and safety of persons in the workplace, and;
  - .2 Knowledgeable about the provisions of occupational health and safety statutes and regulations that apply to the Work and;
  - .3 Knowledgeable about potential or actual danger to health or safety associated with the Work.
- .1 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred.
- 2 PPE: personal protective equipment
- 3 Work Site: where used in this section shall mean areas, located at the premises where Work is undertaken, used by Contractor to perform all of the activities associated with the performance of the Work.

### **1.3 SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00.
  - 2 Submit site-specific Health and Safety Plan prior to commencement of Work.
    - .1 Submit within 5 work days of notification of Bid Acceptance. Provide 3 copies.
    - .2 Departmental Representative will review Health and Safety Plan and provide comments.
    - .3 Revise the Plan as appropriate and resubmit within 5 work days after receipt of comments.
    - .4 Departmental Representative's review and comments made of the Plan shall not be construed as an endorsement, approval or implied warranty of any kind by Canada and does not reduce Contractor's overall responsibility for Occupational Health and Safety of the Work.
-

- .5 Submit revisions and updates made to the Plan during the course of Work.
  
- 3 Submit name of designated Health & Safety Site Representative and support documentation specified in the Safety Plan.
  
- 4 Submit building permit, compliance certificates and other permits obtained.
  
- 5 Submit copy of Letter in Good Standing from Provincial Workers Compensation or other department of labour organization.
  - .1 Submit update of Letter of Good Standing whenever expiration date occurs during the period of Work.
  
- .6 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
  
- .7 Submit copies of incident reports.
  
- .8 Submit WHMIS MSDS - Material Safety Data Sheets.

#### **1.4 COMPLIANCE REQUIREMENTS**

- 1 Comply with Occupational Health and Safety Act for Province of Prince Edward Island, and Occupational Health & Safety Regulations made pursuant to the Act.
  
  - 2 Comply with Canada Labour Code - Part II (entitled Occupational Health and Safety) and the Canada Occupational Health and Safety Regulations (COSH) as well as any other regulations made pursuant to the Act.
    - .1 The Canada Labour Code can be viewed at: [www.http://laws.justice.gc.ca/en/L-2/](http://laws.justice.gc.ca/en/L-2/)
    - .2 COSH can be viewed at: [www.http://laws.justice.gc.ca/eng/SOR-86-304/](http://laws.justice.gc.ca/eng/SOR-86-304/) ne.html
    - .3 A copy may be obtained at: Canadian Government Publishing Public Works & Government Services Canada Ottawa, Ontario, K1A 0S9 Tel: (819) 956-4800 (1-800-635-7943) Publication No. L31-85/2000 E or F)
  
  - 3 Observe construction safety measures of:
    - .1 Part 8 of National Building Code
    - .2 Municipal by-laws and ordinances.
  
  - 4 In case of conflict or discrepancy between above specified requirements, the more stringent shall apply.
-

- 5 Maintain Workers Compensation Coverage in good standing for duration of Contract. Provide proof of clearance through submission of Letter in Good Standing.
- 6 Medical Surveillance: Where prescribed by legislation or regulation, obtain and maintain worker medical surveillance documentation.

## **1.5 RESPONSIBILITY**

- 1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons and environment adjacent to the site to extent that they may be affected by conduct of Work.
- 2 Comply with and enforce compliance by all workers, sub-contractors and other persons granted access to Work Site with safety requirements of Contract Documents, applicable federal, provincial, and local by-laws, regulations, and ordinances, and with site-specific Health and Safety Plan.

## **1.6 SITE CONTROL AND ACCESS**

- 1 Control the Work and entry points to Work Site. Approve and grant access only to workers and authorized persons. Immediately stop and remove non-authorized persons.
    - .1 Departmental Representative will provide names of those persons authorized by Departmental Representative to enter onto Work Site and will ensure that such authorized persons have the required knowledge and training on Health and Safety pertinent to their reason for being at the site, however, Contractor remains responsible for the health and safety of authorized persons while at the Work Site.
  - 2 Isolate Work Site from other areas of the premises by use of appropriate means.
    - .1 Erect fences, hoarding, barricades and temporary lighting as required to effectively delineate the Work Site, stop non-authorized entry, and to protect pedestrians and vehicular traffic around and adjacent to the Work and create a safe environment. See Section 01 56 00 for minimum acceptable requirements.
    - .2 Post signage at entry points and other strategic locations indicating restricted access and conditions for access.
    - .3 Use professionally made signs with bilingual message in the 2 official languages or international known graphic symbols.
  - 3 Provide safety orientation session to persons granted access to Work Site. Advise of hazards and safety rules to be observed while on site.
  - 4 Ensure persons granted site access wear appropriate PPE. Supply PPE to inspection authorities who require access to conduct tests or perform inspections.
-

- 5 Secure Work Site against entry when inactive or unoccupied and to protect persons against harm.

### **1.7 PROTECTION**

- .1 Give precedence to safety and health of persons and protection of environment over cost and schedule considerations for Work.
- 2 Should unforeseen or peculiar safety related hazard or condition become evident during performance of Work, immediately take measures to rectify situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.

### **1.8 FILING OF NOTICE**

- .1 File Notice of Project with pertinent provincial health and safety authorities prior to beginning of Work.
  - .1 Departmental Representative will assist in locating address if needed.

### **1.9 PERMITS**

- .1 Post permits, licenses and compliance certificates, specified in section 01 10 10, at Work Site.
- 2 Where a particular permit or compliance certificate cannot be obtained, notify Departmental Representative in writing and obtain approval to proceed before carrying out applicable portion of work.

### **1.10 HAZARD ASSESSMENTS**

- .1 Perform site specific health and safety hazard assessment of the Work and its site.
- 2 Carryout initial assessment prior to commencement of Work with further assessments as needed during progress of work.
- 3 Record results and address in Health and Safety Plan.
- 4 Keep documentation on site for entire duration of the Work.

### **1.11 PROJECT/SITE CONDITIONS**

- .1 Following are potential health, environmental and safety hazards at the site for which Work may involve contact with:
    - .1 Known latent site and environmental conditions:
      - .1 Buried utilities.
    - .2 Facility on-going operations:
      - .1 Vehicle traffic from operational parking lot.
-

- .3 Construction hazards:
  - .1 Heavy equipment traffic.
- 2 Above items shall not be construed as being complete and inclusive of potential health and safety hazards encountered during Work.
- 3 Include above items in the hazard assessment of the Work.
- 4 MSDS Data sheets of pertinent hazardous and controlled products stored on site can be obtained from Departmental Representative.

### **1.12 MEETINGS**

- .1 Attend pre-construction health and safety meeting, convened and chaired by Departmental Representative, prior to commencement of Work, at time, date and location determined by Departmental Representative. Ensure attendance of:
  - .1 Superintendent of Work
  - .2 Designated Health & Safety Site Representative
  - .3 Subcontractors
- 2 Conduct regularly scheduled tool box and safety meetings during the Work in conformance with Occupational Health and Safety regulations.
- 3 Keep documents on site.

### **1.13 HEALTH AND SAFETY PLAN**

- .1 Prior to commencement of Work, develop written Health and Safety Plan specific to the Work. Implement, maintain, and enforce Plan for entire duration of Work and until final demobilization from site.
- 2 Health and Safety Plan shall include the following components:
  - .1 List of health risks and safety hazards identified by hazard assessment.
  - .2 Control measures used to mitigate risks and hazards identified.
  - .3 On-site Contingency and Emergency Response Plan as specified below.
  - .4 On-site Communication Plan as specified below.
  - .5 Name of Contractor's designated Health & Safety Site Representative and information showing proof of his/her competence and reporting relationship in Contractor's company.
  - .6 Names, competence and reporting relationship of other supervisory personnel used in the Work for occupational health and safety purposes.
- 3 On-site Contingency and Emergency Response Plan shall include:
  - .1 Operational procedures, evacuation measures and communication process to be implemented in the event of an emergency.
  - .2 Evacuation Plan: site and floor plan layouts showing escape routes, marshalling areas. Details on alarm notification methods, fire drills, location of fire fighting equipment and other related data.

- .3 Name, duties and responsibilities of persons designated as Emergency Warden(s) and deputies.
  - .4 Emergency Contacts: name and telephone number of officials from:
    - .1 General Contractor and subcontractors.
    - .2 Pertinent Federal and Provincial Departments and Authorities having jurisdiction.
    - .3 Local emergency resource organizations.
  - .5 Harmonize Plan with Facility's Emergency Response and Evacuation Plan. Departmental Representative will provide pertinent data including name of Facility Management contacts.
- 4 On-site Communication Plan:
    - .1 Procedures for sharing of work related safety information to workers and subcontractors, including emergency and evacuation measures.
    - .2 List of critical work activities to be communicated with Facility Manager which have a risk of endangering health and safety of Facility users.
  - 5 Address all activities of the Work including those of subcontractors.
  - 6 Review Health and Safety Plan regularly during the Work. Update as conditions warrant to address emerging risks and hazards, such as whenever new trade or subcontractor arrive at Work Site.
  - 7 Departmental Representative will respond in writing, where deficiencies or concerns are noted and may request re-submission of the Plan with correction of deficiencies or concerns.
  - 8 Post copy of the Plan, and updates, prominently on Work Site.

#### **1.14 SAFETY SUPERVISION**

- 1 Employ Health & Safety Site Representative responsible for daily supervision of health and safety of the Work.
- 2 Health & Safety Site Representative may be the Superintendent of the Work or other person designated by Contractor and shall be assigned the responsibility and authority to:
  - .1 Implement, monitor and enforce daily compliance with health and safety requirements of the Work
  - .2 Monitor and enforce Contractor's site-specific Health and Safety Plan.
  - .3 Conduct site safety orientation session to persons granted access to Work Site.
  - .4 Ensure that persons allowed site access are knowledgeable and trained in health and safety pertinent to their activities at the site or are escorted by a competent person while on the Work Site.
  - .5 Stop the Work as deemed necessary for reasons of health and safety.

- 3 Health & Safety Site Representative must:
  - .1 Be qualified and competent person in occupational health and safety.
  - .2 Have site-related working experience specific to activities of the Work.
  - .3 Be on Work Site at all times during execution of the Work.
- 4 All supervisory personnel assigned to the Work shall also be competent persons.
- 5 Inspections:
  - .1 Conduct regularly scheduled safety inspections of the Work on a minimum bi-weekly basis. Record deficiencies and remedial action taken.
- .6 Cooperate with Facility's Occupational Health and Safety representative should one be designated by Departmental Representative.
- .7 Keep inspection reports and supervision related documentation on site.

#### **1.15 TRAINING**

- 1 Use only skilled workers on Work Site who are effectively trained in occupational health and safety procedures and practices pertinent to their assigned task.
- 2 Maintain employee records and evidence of training received. Make data available to Departmental Representative upon request.
- 3 When unforeseen or peculiar safety-related hazards, or conditions occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

#### **1.16 MINIMUM SITE SAFETY RULES**

- 1 Notwithstanding requirement to abide by federal and provincial health and safety regulations; ensure the following minimum safety rules are obeyed by persons granted access to Work Site:
  - .1 Wear appropriate PPE pertinent to the Work or assigned task; minimum being hard hat, safety footwear, safety glasses and hearing protection.
  - .2 Immediately report unsafe condition at site, near-miss accident, injury and damage.
  - .3 Maintain site and storage areas in a tidy condition free of hazards causing injury.
  - .4 Obey warning signs and safety tags.
- 2 Brief persons of disciplinary protocols to be taken for non-compliance. Post rules on site.

### **1.17 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative will stop Work if non-compliance of health and safety regulations is not corrected in a timely manner.

### **1.18 INCIDENT REPORTING**

- .1 Investigate and report the following incidents to Departmental Representative:
  - .1 Incidents requiring notification to Provincial Department of Occupational Safety and Health, Workers Compensation Board or to other regulatory Agency.
  - .2 Medical aid injuries.
  - .3 Property damage.
  - .4 Interruptions to Facility operations.
- .2 Submit report in writing.

### **1.19 HAZARDOUS PRODUCTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS).
- .2 Keep MSDS data sheets for all products delivered to site.
  - .1 Post on site.
  - .2 Submit copy to Departmental Representative.
  - .3 For interior work in an occupied Facility, post additional copy in one or more publicly accessible locations.

### **1.20 BLASTING**

- .1 Blasting or other use of explosives is not permitted.

### **1.21 CONFINED SPACES**

- .1 Abide by occupational health and safety regulations regarding work in confined spaces.
-

- .2 Obtain an Entry Permit in accordance with Part XI of the Canada Occupational Health and Safety Regulations for entry into an existing identified confined space located at the Facility or premises of Work.
  - .1 Obtain permit from Facility Manager
  - .2 Keep copy of permit issued.

### **1.22 SITE RECORDS**

- .1 Maintain on Work Site copy of safety related documentation and reports stipulated to be produced in compliance with Acts and Regulations of authorities having jurisdiction and of those documents specified herein.
- .2 Upon request, make available to Departmental Representative or authorized Safety Officer for inspection.

### **1.23 POSTING OF DOCUMENTS**

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on Work Site in accordance with Acts and Regulations of Province having jurisdiction.
- .2 Post other documents as specified herein, including:
  - .1 Site specific Health and Safety Plan
  - .2 WHMIS data sheets

### **PART 2 - PRODUCTS**

Not applicable.

### **PART 3 - EXECUTION**

Not applicable.

## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **1.2 DEFINITIONS**

- .1 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals or plant life when released into the environment.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

### **1.3 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction.
  - .3 Address topics at level of detail commensurate with environmental issue and required construction tasks.
  - .4 Environmental protection plan: include:
    - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
    - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
    - .3 Names and qualifications of persons responsible for training site personnel.
    - .4 Descriptions of environmental protection personnel training program.
    - .5 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
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- .6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
- .7 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .8 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .9 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
- .10 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .11 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

#### **1.4 FIRES**

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

#### **1.5 DISPOSAL OF WASTES AND HAZARDOUS MATERIALS**

- .1 Do not bury rubbish and waste materials on site. Dispose at approved landfill sites as specified in Section 01 74 21.
  - .2 Do not dispose of hazardous waste or volatile materials such as mineral spirits, paint thinner, oil or fuel into waterways, storm or sanitary sewers or waste landfill sites.
  - .3 Store, handle and dispose of hazardous materials and hazardous waste in accordance with applicable federal and provincial laws, regulations, codes and guidelines.
  - .4 Dispose of construction waste materials and demolition debris, resulting from work, at approved landfill sites only. Carry out such disposal in strict accordance with provincial and municipal rules and regulations. Separate out and prevent improper disposal of items banned from landfills.
-

- .5 Establish methods and undertake construction practices which will minimize waste and optimize use of construction materials. Separate at source all construction waste materials, demolition debris and product packaging and delivery containers into various recycling abilities of various materials and avoid disposal of debris at landfill site(s) in a "mixed state". Where recycling firms specializing in recycling of specific materials exist, transport such materials to the recycling facility and avoid disposal at landfill sites.
- .6 Communicate with landfill operator prior to commencement of work, to determine what specific construction, demolition and renovation waste materials have been banned from disposal at the landfill and at transfer stations.

## **1.6 DRAINAGE**

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with governing regulations and requirements.
- .4 Pumped water must meet applicable federal, provincial and municipal standards before it can be discharged to a surface water body. If regulatory guidelines exceedances are noted, the Departmental Representative has the right to issue stop pumping instructions to the Contractor. Contractor will not be compensated for any delays associated with retrofitting equipment to meet guidelines.
- .5 Provide control devices such as filter fabrics, sediment traps and settling ponds to control drainage and prevent erosion of adjacent lands. Maintain in good order for duration of work.

## **1.7 PERMITS**

- .1 Contractor is responsible to pay applicable fees and obtain all necessary regulatory permits for the disposal of hazardous or contaminated waste, including, but not limited to acid bearing rock material.
- .2 All guidelines and instructions stated on permits must be strictly adhered to.

## **1.8 WORK ADJACENT TO WATERWAYS**

- .1 Do not operate construction equipment in waterways.
-

- .2 Do not use waterway beds for borrow material.
- .3 Do not dump excavated fill, waste material or debris in waterways.
- .4 At borrow sites, design and construct temporary crossings to minimize erosion to waterways in strict conformance with provincial and federal environmental regulations.
- .5 Do not skid logs or construction materials across waterways.
- .6 Do not refuel any type of equipment within 100 m of a water body. Maintain equipment in good working condition with no fluid leaks, loose hoses or fittings.
- .7 Temporary diversion ditches, approved by the Departmental Representative are to be plastic lined.

## **1.9 POLLUTION CONTROL**

- .1 Maintain temporary erosion and pollution control features installed under this contract.
  - .2 Control emissions from equipment and plant to local authorities' emission requirements.
  - .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
  - .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
  - .5 Provide dust control for temporary roads and around entire construction site.
  - .6 Maintain inventory of hazardous materials and hazardous waste stored on site.
  - .7 List items by product name, quantity and date when storage began.
  - .8 Have emergency spill response equipment and rapid clean-up kit, appropriate to work, at site. Locate adjacent to work and where hazardous materials are stored. Provide personal protective equipment as required for clean-up.
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- .9 Report, to Federal and Provincial Department of the Environment, spills of petroleum and other hazardous materials as well as accidents having potential of polluting the environment. Also notify Departmental Representative and submit a written spill report to Departmental Representative within 24 hours of occurrence.
  
- .10 Provide a floating debris containment boom whenever any of the Contractors methods of work allow for the potential of floating debris.

### **1.10 WILDLIFE PROTECTION**

- .1 Should nests of migratory birds in wetlands be encountered during work, immediately notify Departmental Representative for directives to be followed.
  - .1 Do not disturb nest site and neighbouring vegetation until nesting is completed.
  - .2 Minimize work immediately adjacent to such areas until nesting is completed.
  - .3 Protect these areas by following recommendations of Canadian Wildlife Service.

### **PART 2 - PRODUCTS**

Not applicable

### **PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.

### **1.2 INSPECTION**

- .1 Facilitate Departmental Representative's access to Work. If part of Work is being fabricated at locations other than construction site, make preparations to allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection of Work designated for special tests, inspections or approvals by Departmental Representative or by inspection authorities having jurisdiction.
- .3 If Contractor covers or permits to be covered Work designated for special tests, inspections or approvals before such is made, uncover Work until particular inspections or tests have been fully and satisfactorily completed and until such time as Departmental Representative gives permission to proceed. Pay costs to uncover and make good such Work.
- .4 In accordance with the General Conditions, Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents.

### **1.3 INDEPENDENT INSPECTION AGENCIES**

- .1 Departmental Representative will engage and pay for service of Independent Inspection and Testing Agencies for purpose of inspecting and testing portions of Work except for the following which remain part of Contractor's responsibilities:
    - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
    - .2 Inspection and testing performed exclusively for Contractor's convenience.
    - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
    - .4 Mill tests and certificates of compliance.
    - .5 Tests as specified within various sections designated to be carried out by Contractor under the supervision of Departmental Representative.
    - .6 Additional tests specified in Section 01 29 83, Clause 1.2.
-

- .2 Where tests or inspections by designated Testing Agency reveal work not in accordance with contract requirements, Contractor shall pay costs for additional tests or inspections as Departmental Representative may require to verify acceptability of corrected work.
- .3 Employment of inspection and testing agencies by Departmental Representative does not relax responsibility to perform Work in accordance with Contract Documents.

#### **1.4 ACCESS TO WORK**

- .1 Furnish labour and facility to provide access to the work being inspected and tested.
- .2 Cooperate to facilitate such inspections and tests.
- .3 Make good work disturbed by inspections and tests.

#### **1.5 PROCEDURES**

- .1 Notify Departmental Representative sufficiently in advance of when work is ready for tests, in order for Departmental Representative to make attendance arrangements with Testing Agency. When directed by Departmental Representative, notify such Agency directly.
- .2 Submit representative samples of materials specified to be tested. Deliver in required quantities to Testing Agency. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples on site. Provide sufficient space on site for Testing Agency's exclusive use to store equipment and cure test samples.

#### **1.6 REJECTED WORK**

- .1 Remove and replace defective Work, whether result of poor workmanship, use of defective or damaged products and whether incorporated in Work or not, which has been identified by Departmental Representative as failing to conform to Contract Documents.
  - .2 Make good damages to existing or new work, including work of others, resulting from removal or replacement of defective work.
-

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**1.7 TESTING BY CONTRACTOR**

- .1 Provide all necessary instruments, equipment and qualified personnel to perform tests designated as Contractor's responsibilities herein or elsewhere in the Contract Documents.
- .2 Contractor shall engage a professional engineer, licensed to practice in Prince Edward Island to provide geotechnical certification of granular aggregate materials, including material specifications, placement and compaction of pipe bedding material, sub-base construction, and granular aggregate structure, as well as slope stability certification of all slopes equal to or greater than 2:1 (horizontal:vertical).
- .3 At completion of tests, turn over two (2) copies of fully documented test reports to Departmental Representative. Additionally, obtain other copies in sufficient quantities to enable one (1) complete set of test reports to be placed in each of the maintenance manuals specified in Section 01 78 00.
- .4 Submit mill test certificates and other certificates as specified in various sections.
- .5 Furnish test results and mix designs as specified in various sections.

**1.8 EQUIPMENT AND SYSTEMS**

- .1 Refer to Section 01 33 00 – Submittal Procedures

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 52 00 - Construction Facilities.
- .2 Section 01 56 00 - Temporary Barriers and Enclosures.

### **1.2 INSTALLATION AND REMOVAL**

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use or as directed by Departmental Representative.

### **1.3 DEWATERING**

- .1 Provide temporary drainage to keep excavations and site free from standing water.
- .2 Ensure discharge is not contaminated with sediment, oil, etc.

### **1.4 TEMPORARY HEATING AND VENTILATION**

- .1 Pay for costs of temporary heat, and pumping used during construction, including costs of supply, installation, fuel, operation, maintenance, and removal of equipment, if applicable.
  - .2 Maintain strict supervision of operation of temporary heating and pumping equipment:
    - .1 Conform with applicable codes and standards.
    - .2 Enforce safe practices.
    - .3 Prevent abuse of services.
    - .4 Prevent damage to finishes.
  - .3 Provide temporary heating and hoarding as required to:
    - .1 Facilitate progress of Work.
    - .2 Protect Work and products against dampness and cold.
    - .3 Prevent moisture condensation on surfaces.
    - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
    - .5 Provide adequate ventilation to meet health regulations for safe working environment.
-

- .4 Hoard, heat and provide protection for curing concrete in accordance with Section 03 30 00 - Cast In Place Concrete.
- .5 Allow Departmental Representative to inspect methods for fire safety.

### **1.5 TEMPORARY POWER AND LIGHT**

- .1 Departmental Representative will not provide or pay for temporary power during construction for temporary lighting and operating of power tools.
- .2 Arrange for connection with appropriate utility company. Pay all costs for supply, installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .4 Provide and maintain temporary lighting throughout project.
- .5 Coordinate with all existing users.
- .6 Supply and install temporary facilities for power to approval of local power supply authorities.
- .7 Provide and pay for temporary power and lights for use of Departmental Representative site office.

### **1.6 TEMPORARY COMMUNICATION FACILITIES**

- .1 Provide and pay for temporary telephone, fax and data hook up, line(s) and equipment as necessary for own use and use of Departmental Representative.

### **1.7 FIRE PROTECTION**

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

### **1.8 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.
  - .3 Keep area and premises in sanitary condition.
-

**1.9 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.

**1.10 ACCESS**

- .1 Provide and maintain adequate access to project site.
- .2 Build and maintain temporary roads where indicated and provide snow removal during period of work.
- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
- .4 All surface modifications are restricted to the identified construction corridors. Accurate delineation of these corridors by field survey prior to commencement of construction is required.
- .5 All vehicle traffic is restricted to existing roadways or as indicated in project plans. A field visit will be scheduled with the Contractor for locational confirmation and all areas of proposed construction will be marked in the field with orange flagging tape prior to commencement of work.

**PART 2 – PRODUCTS**

Not applicable

**PART 3 – EXECUTION**

Not applicable

END

## **PART 1 - GENERAL**

### **1.1 INSTALLATION AND REMOVAL**

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be graveled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

### **1.2 CONTRACTOR'S SITE OFFICE**

- .1 Be responsible for and provide own site office, if required, including electricity, heat, lights and telephone. Locate site office as directed by Departmental Representative.

### **1.3 SITE STORAGE/LOADING**

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

### **1.4 CONSTRUCTION PARKING**

- .1 Parking will be permitted in designated Contractor Parking Area.
  - .2 Provide and maintain adequate access to project site.
  - .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.
-

### **1.5 EQUIPMENT, TOOL AND MATERIALS STORAGE**

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

### **1.6 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.
- .3 Keep area and premises in sanitary condition.

### **1.7 CONSTRUCTION SIGNS AND NOTICES**

- .1 Contractor or sub-contractor advertisement signboards are not permitted on site.
- .2 Only notices of safety or instructions are permitted on site.
- .3 Safety and Instruction Signs and Notices:
  - .1 Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to CAN/CSA-Z321-96 (Latest Edition).
- .4 Maintenance and Disposal of Site Signs:
  - .1 Maintain approved signs and notices in good condition for duration of project and dispose of off site on completion of project or earlier if directed by Departmental Representative.

### **1.8 PROTECTION AND MAINTENANCE OF TRAFFIC**

- .1 Provide access and temporary relocated roads as necessary to maintain traffic, including foot traffic.
  - .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
  - .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs
  - .4 Protect travelling public from damage to person and property.
-

- .5 Verify adequacy of existing roads and allowable load limit on these roads. Contractor responsible for repair of damage to roads caused by construction operations.
- .6 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .7 Provide adequate dust control to ensure safe operation at all times.
- .8 Provide adequate lighting to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .9 Provide snow removal of the work area during period of Work.

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 INSTALLATION AND REMOVAL**

- .1 Provide temporary controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

### **1.2 GUARD RAILS AND BARRICADES**

- .1 Provide secure, rigid guard rails and barricades around open excavations.
- .2 Provide as required by governing authorities.

### **1.3 ACCESS TO SITE**

- .1 Provide and maintain access roads, crossings, ramps and construct runways as may be required for site access including snow clearing of work areas.

### **1.4 PUBLIC TRAFFIC FLOW**

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform work and protect the public.

### **1.5 FIRE ROUTES**

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

### **1.6 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

- .1 Protect surrounding private and public property from damage during performance of work.
- .2 Be responsible for damage incurred.

### **1.7 PROTECTION OF BUILDING FINISHES**

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
  - .2 Provide necessary screens, covers, and hoardings.
-

- .3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 REFERENCES**

- .1 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .3 Cost of such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

### **1.2 QUALITY**

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
  - .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
  - .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
  - .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
  - .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
  - .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.
-

### **1.3 AVAILABILITY**

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

### **1.4 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
  - .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
  - .3 Store products subject to damage from weather in weatherproof enclosures.
  - .4 Store cementitious products clear of earth or concrete floors, and away from walls.
  - .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
  - .6 Store sheet materials and lumber on flat, solid supports and keep clear of ground.
  - .7 Slope to shed moisture.
  - .8 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
-

- .9 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .10 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

### **1.5 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

### **1.6 QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

### **1.7 CO-ORDINATION**

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
  - .2 Be responsible for coordination and placement of openings, sleeves and accessories.
-

**1.8 REMEDIAL WORK**

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

**1.9 PROTECTION OF WORK IN PROGRESS**

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

**1.10 EXISTING UTILITIES**

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

## **PART 1 – GENERAL**

### **1.1 REFERENCES**

- .1 Departmental Representative's identification of existing survey control points and property limits.

### **1.2 QUALIFICATIONS OF SURVEYOR**

- .1 Qualified registered land surveyor licensed to practice in Province of Prince Edward Island, acceptable to Departmental Representative.

### **1.3 SURVEY REFERENCE POINTS**

- .1 Existing base horizontal and vertical control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Departmental Representative.
- .4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

### **1.4 SURVEY REQUIREMENTS**

- .1 Establish one temporary bench mark on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
  - .2 Establish lines and levels, locate and lay out, by instrumentation.
  - .3 Stake for grading, fill placement and landscaping features.
  - .4 Stake slopes.
  - .5 Establish pipe invert elevations.
-

## **1.5** **EXISTING SERVICES**

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

## **1.6** **LOCATION OF EQUIPMENT AND FIXTURES**

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

## **1.7** **RECORDS**

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of site works, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

## **1.8** **SUBMITTALS**

- .1 Submit name and address of Surveyor to Departmental Representative.
  - .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
  - .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.
-

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 GENERAL**

- .1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
- .2 Store volatile wastes in covered metal containers, and remove from premises at end of each working day.
- .3 Prevent accumulation of wastes which create hazardous conditions.
- .4 Provide adequate ventilation during use of volatile or noxious substances.

### **1.2 MATERIALS**

- .1 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

### **1.3 CLEANING DURING CONSTRUCTION**

- .1 Maintain project grounds, and public properties in a tidy condition, free from accumulation of waste materials and debris. Clean areas on a daily basis.
- .2 Provide on site garbage containers for collection of waste materials and debris.
- .3 Remove waste materials and debris from the site or building each day.

### **1.4 FINAL CLEANING**

- .1 In preparation for acceptance of the Work perform final cleaning.
  - .2 Inspect finishes, fitments and equipment. Ensure specified workmanship and operation.
  - .3 Broom clean exterior paved and concrete surfaces; rake clean other surfaces of grounds.
-

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 35 43 - Environmental Procedures.
- .2 Section 03 30 00 - Cast-in-Place Concrete.

### **1.2 WASTE MANAGEMENT PLAN**

- .1 Prior to commencement of work, prepare Waste Management Workplan.
- .2 Workplan to include:
  - .1 Waste audit.
  - .2 Waste reduction practices.
  - .3 Material source separation process.
  - .4 Procedures for sending recyclables to recycling facilities.
  - .5 Procedures for sending non-salvageable items and waste to approved waste processing facility or landfill site.
  - .6 Training and supervising workforce on waste management at site.
- .3 Workplan to incorporate waste management requirements specified herein and in other sections of the Specifications.
- .4 Develop Workplan in collaboration with all subcontractors to ensure all waste management issues and opportunities are addressed.
- .5 Submit copy of Workplan to Departmental Representative for review and approval.
- .6 Make revisions to Plan as directed by Departmental Representative.
- .7 Implement and manage all aspects of Waste Management Workplan for duration of work.
- .8 Revise Plan as work progresses addressing new opportunities for diversion of waste from landfill.

### **1.3 WASTE AUDIT**

- .1 At project start-up, conduct waste audit of:
    - .1 Site conditions identifying salvageable and non-salvageable items and waste resulting from demolition and removal work.
-

- .2 Projected waste resulting from product packaging and from material leftover after installation work.
- .2 Develop written list. Record type, composition and quantity of various salvageable items and waste anticipated, reasons for waste generation and operational factors which contribute to waste.

#### **1.4 WASTE REDUCTION**

- .1 Based on waste audit, develop waste reduction program.
- .2 Structure program to prioritize actions, with waste reduction as first priority, followed by salvage and recycling effort, then disposal as solid waste.
- .3 Identify materials and equipment to be:
  - .1 Protected and turned over to Departmental Representative when indicated.
  - .2 Salvaged for resale by Contractor.
  - .3 Sent to recycling facility.
  - .4 Sent to waste processing/landfill site for their recycling effort.
  - .5 Disposed of in approved landfill site.
- .4 Reduce construction waste during installation work. Undertake practices which will minimize waste and optimize full use of new materials on site, such as:
  - .1 Use of a central cutting area to allow for easy access to off-cuts;
  - .2 Use of off-cuts for blocking and bridging elsewhere.
  - .3 Use of effective and strategically placed facilities on site for storage and staging of left-over or partially cut materials (such as gypsum board, plywood, ceiling tiles, insulation, etc.) to allow for easy incorporation into work whenever possible avoiding unnecessary waste.
- .5 Develop other strategies and innovative procedures to reduce waste such as minimizing the extent of packaging used for delivery of materials to site, etc.

#### **1.5 MATERIAL SOURCE SEPARATION PROCESS**

- .1 Develop and implement material source separation process at commencement of work as part of mobilization and waste management at site.
  - .2 Provide on-site facilities to collect, handle and store anticipated quantities of reusable, salvageable and recyclable materials.
    - .1 Use suitable containers for individual collection of items based on intended purpose.
    - .2 Locate to facilitate deposit but without hindering daily operations of existing building tenants.
    - .3 Clearly mark containers and stockpiles as to purpose and use.
-

- .4 Perform demolition and removal of existing structure components and equipment following a systematic deconstruction process.
- .5 Separate materials and equipment at source, carefully dismantling, labelling and stockpiling alike items for the following purposes:
  - .1 Reinstallation into the work where indicated.
  - .2 Salvaging reusable items not needed in project which Contractor may sell to other parties. Sale of such items not permitted on site.
  - .3 Sending as many items as possible to locally available recycling facility.
  - .6 Segregating remaining waste and debris into various individual waste categories for disposal in a "non-mixed state" as recommended by waste processing/landfill sites.
- .3 Isolate product packaging and delivery containers from general waste stream.
- .4 Send to recycling facility or return to supplier/manufacturer.
- .5 Send leftover material resulting from installation work for recycling whenever possible.
- .6 Establish methods whereby hazardous and toxic waste materials, and their containers, encountered or used in the course work are properly isolated, stored on site and disposed in accordance with applicable laws and regulations from authorities having jurisdiction.
- .7 Isolate and store existing materials and equipment identified for re-incorporation into the Work. Protect against damage.

## **1.6 WORKER TRAINING AND SUPERVISION**

- .1 Provide adequate training to workforce, through meetings and demonstrations, to emphasize purpose and worker responsibilities in carrying out the Waste Management Plan.
- .2 Post a copy of Plan in a prominent location on site for review by workers.

## **1.8 DISPOSAL REQUIREMENTS**

- .1 Burying or burning of rubbish and waste materials is prohibited.
  - .2 Disposal of waste, volatile materials, mineral spirits, oil, paint, paint thinner or unused preservative material into waterways, storm, or sanitary sewers is prohibited.
-

- .3 Do not dispose of preservative treated wood through incineration.
- .4 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.
- .5 Dispose of treated wood, end pieces, wood scraps and sawdust at an approved sanitary landfill.
- .6 Dispose of waste only at approved waste processing facility or landfill sites approved by authority having jurisdiction.
- .7 Contact the authority having jurisdiction prior to commencement of work, to determine what, if any, demolition and construction waste materials have been banned from disposal in landfills and at transfer stations. Take appropriate action to isolate such banned materials at site of work and dispose in strict accordance with provincial and municipal regulations.
- .8 Transport waste intended for landfill in separated condition, following rules and recommendations of Landfill Operator in support of their effort to divert, recycle and reduce amount of solid waste placed in landfill.
- .9 Collect, bundle and transport salvaged materials to be recycled in separated categories and condition as directed by recycling facility. Ship materials only to approved recycling facilities.
- .10 Sale of salvaged items by Contractor to other parties not permitted on site.

## **PART 2 - PRODUCTS**

Not applicable

## **PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 INSPECTION AND DECLARATION**

- .1 Contractor's Inspection: Contractor and Subcontractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
  - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
  - .2 Request Departmental Representative Inspection.
- .2 Departmental Representative Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
  - .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, adjusted and balanced and are fully operational.
  - .4 Operation of systems have been demonstrated to stakeholders (coordinated by Departmental Representative).
  - .5 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

### **1.2 CLEANING**

- .1 In accordance with Section 01 74 11 - Cleaning.
  - .2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
-

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

END

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## **PART 1 - GENERAL**

### **1.1 SUBMISSION**

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 If requested, furnish evidence as to type, source and quality of products provided.
- .5 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .6 Pay costs of transportation.

### **1.2 FORMAT**

- .1 Organize data in the form of an instructional manual.
  - .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
  - .3 When multiple binders are used, correlate data into related consistent groupings.
  - .4 Identify contents of each binder on spine.
  - .5 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
  - .6 Arrange content by systems, under Section numbers and sequence of Table of Contents.
  - .7 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
  - .8 Text: Manufacturer's printed data, or typewritten data.
-

- .9 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .10 Provide 1:1 scaled CAD files in dxf or dwg and pdf format on USB Drive.

### **1.3 CONTENTS - EACH VOLUME**

- .1 Table of Contents: provide title of project;
  - .1 date of submission; names,
  - .2 addresses, and telephone numbers of Consultant and Contractor with name of responsible parties;
  - .3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Type written Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

### **1.4 AS-BUILTS AND SAMPLES**

- .1 Maintain at the site for Departmental Representative one record copy of:
    - .1 Contract Drawings.
    - .2 Specifications.
    - .3 Addenda.
    - .4 Change Orders and other modifications to the Contract.
    - .5 Reviewed shop drawings, product data, and samples.
    - .6 Field test records.
    - .7 Inspection certificates.
    - .8 Manufacturer's certificates.
  - .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
-

- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

### **1.5 RECORDING ACTUAL SITE CONDITIONS**

- .1 Record information on set of opaque drawings, provided by Departmental Representative.
- .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
  - .1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - .2 Field changes of dimension and detail.
  - .3 Changes made by change orders.
  - .4 Details not on original Contract Drawings.
  - .5 References to related shop drawings and modifications.
- .4 Specifications: legibly mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.
- .5 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

### **1.6 FINAL SURVEY**

- .1 Submit final site survey certificate, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.
-

**1.7 WARRANTIES AND BONDS**

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

**PART 2 - PRODUCTS**

Not applicable

**PART 3 - EXECUTION**

Not applicable

## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 – Submittal procedures.
- .2 Section 01 61 00 – Common product Requirements.
- .3 Section 01 74 11 – Cleaning.
- .4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

### **1.2 REFERENCES**

- .1 American Association of State Highway and Transportation Officials (AASHTO)
    - .1 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, (5th Edition).
  - .2 Transportation Association of Canada
    - .1 Manual of Uniform Traffic Control Devices for Canada (Latest Edition).
  - .3 ASTM International
    - .1 ASTM A 123/A 123M-09(R2014), Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
    - .2 ASTM A 276-15, Standard Specification for Stainless Steel Bars and Shapes.
    - .3 ASTM B 209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate Metric.
    - .4 ASTM B 210M-12, Standard Specification for Aluminum-Alloy Drawn Seamless Tubes Metric.
    - .5 ASTM B 211M-12e1, Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire Metric.
  - .4 Canadian General Standards Board (CGSB)
    - .1 CGSB 62-GP-9M-80, Prefabricated Markings, Positionable, Exterior, for Aircraft Ground Equipment and Facilities.
    - .2 CGSB 62-GP-11M-78, Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing and Amendment.
  - .5 CSA International
    - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
    - .2 CAN/CSA O80 Series-08, Wood Preservation.
    - .3 CSA O121-08(R2013), Douglas Fir Plywood.
-

- .4 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum.
- .5 CAN/CSA-Z809-08, Sustainable Forest Management.
- .6 Forest Stewardship Council (FSC)
  - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .7 Green Seal Environmental Standards (GS)
  - .1 GS-11-11, Paints and Coatings.
- .8 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2011, Architectural Coatings.
- .9 Sustainable Forestry Initiative (SFI)
  - .1 SFI-2010-2014 Standard.
- .10 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.

### **13 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for traffic signage, including product characteristics, performance criteria, physical size, finish and limitations.

### **14 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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.
  - .1 Storage and Handling Requirements:
    - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .2 Replace defective or damaged materials with new.

- .2 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Sign supports:
  - .1 In accordance with Halifax Standard tubular supports for small signs: to ASTM B 210M.
  - .2 Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.
- .2 Signboards:
  - .1 Aluminum sheet: to ASTM B 209M, precut to required dimensions.
    - .1 Thickness for signboards up to 750 mm wide: 1.6 mm minimum.
  - .2 Aluminum extrusions: to ASTM B 211M, 150 mm or 300 mm panels suitable for bolting together.
  - .3 T-shape stiffeners for signboards: to ASTM B 210M.
  - .4 Connecting straps and brackets: to ASTM B 209M.
  - .5 Aluminum materials: to ASTM B 209M.
  - .6 Reflective background and lettering in accordance with Manual of Uniform Traffic Control Devices and CSA B651 Barrier Free Design.

## **PART 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. Where separate concrete footings have been placed, erect posts with base plates resting on levelling nuts and restrained with nuts and washers. Permissible tolerance: 12 mm maximum departure from vertical.

- .2 Coat underside of base plate with corrosion protective paint before installation. Connect shoe base to shaft with inside and outside fillet welds.
- .3 Close open aluminum tubes and posts with aluminum cap. Cut oblong holes in shoe bases to drain condensation. Install aluminum bolt cover on each base plate restraining nut.
- .4 Erect posts plumb and square to details as indicated.
- .5 Single channel steel posts:
  - .1 Drive to required depth without damage to posts.
  - .2 If rock or concrete is encountered, drill hole to required depth and set post in sand.
  - .3 In finished concrete surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.
- .2 Signboard:
  - .1 Fasten signboards to supporting posts and brackets as indicated.
  - .2 Fasten lane markers to signboard.
  - .3 Use strapping with crimped or bolted connections where signs fastened to utility poles.
  - .4 Use T-shape aluminum stiffeners to join portions of sign panel on site.
  - .5 Cover face of T-stiffener with material identical to face of sign panel.

### **3.2 CORRECTING DEFECTS**

- .1 Correct defects, identified by Departmental 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 Departmental Representative.

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Carefully dismantle and salvage wood, aluminum and steel materials for reuse and recycling.

- .3 Dismantle electrical equipment. Terminate power feed as indicated. Salvage luminaires and pack in weatherproof containers with glassware adequately protected. Salvage brackets, hardware and. Salvage Dispose of lamps, wiring, conduit and accessories.
- .4 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .5 Deliver salvaged materials to.

### **34 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by traffic signage installation and salvage operations.

END

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DIVISION 26

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26 05 21	Wires and Cables (0-1000V) .....	05
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26 05 43.01	Installation of Cables in Trenches and in Ducts.....	02
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DIVISION 33

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33 71 73.02	Underground Electrical Service .....	03

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 This Section covers items common to Sections of Division 26, Division 27, Division 28, and Division 33. This section also covers sections 23 82 33 and 48 14 00. This Section also supplements requirements of Division 01.

**1.2 RELATED REQUIREMENTS**

- .1 None.

**1.3 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA):
  - .1 CSA C22.1-2021, Canadian Electrical Code, Part 1 (25<sup>th</sup> Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.3 No. 7-2020, Underground Systems
  - .3 CSA Z85-1983, Abbreviations for Electrical Terms.
  - .4 CSA CAN3-C235-1983 (R2015), Preferred Voltage Levels for AC Systems, 0 to 50 000 V
- .2 Health Canada Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheet (SDS).
- .3 Institute of Electrical and Electronics (IEEE):
  - .1 IEEE 100-2000, The Authoritative Dictionary of IEEE Standards Terms.
- .4 National Research Council of Canada (NRCC):
  - .1 NBC-2015, National Building Code of Canada
- .5 Underwriters Laboratories (UL) Standards.

**1.4 DEFINITIONS**

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE 100.
- .2 Abbreviations for electrical terms: to CSA Z85.

**1.5 CONTRACT DRAWINGS**

- .1 No omissions in the drawings or specifications are intended and the Contractor shall give due consideration to this matter. Any work or material referred to in the drawings and not in the specifications, or vice versa, shall be furnished and performed as though fully covered in both. This shall apply particularly to the drawings where descriptions are sufficiently detailed so as to require little or no mention in the specifications. Items indicated on floor plans and not on riser diagrams, or vice versa, shall be considered fully covered by both.
- .2 Runs of conduit and outlet locations indicated on the drawings are diagrammatic and exact locations must be determined by the Contractor as the work proceeds, with due regard to the structure and the work of other trades. The Consultant reserves the right to alter locations of conduit and outlets up to 3 m without extra cost, provided that the Contractor is advised prior to roughing in. The Contractor shall make any changes

dictated by structural requirements, or conflicts with other trades, without charge to the Departmental Representative.

- .3 Any error or omission shall be referred to the Departmental Representative whose decision shall be final.
- .4 Building dimensions shall not be scaled from the electrical drawings but shall be obtained from the Architectural and/or Structural drawings. Any discrepancy between the drawings and the building shall be questioned before proceeding with the installation.

## **1.6 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CSA CAN3-C235.
- .2 Distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.

## **1.7 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Submit for review single line electrical diagrams, drawing 914mm x 610mm minimum size, under plexiglass and locate as indicated.
  - .1 Electrical distribution system in all electrical rooms.
- .3 Shop drawings:
  - .1 The Contractor shall prepare shop drawings showing in detail the design and construction of all equipment, panels, cabinets, lighting fixtures, etc.. High quality electronic “PDF” copies of shop drawings shall be submitted to the Departmental Representative for review, and the work shall not be executed until such review has been obtained.
  - .2 All shop drawings, other than standard manufacturers' dimensions and data sheets, shall bear the stamp of a registered professional Engineer who shall be fully responsible for the Engineering content of such drawings.
  - .3 Prior to submission the Contractor shall carefully check all shop drawings to ensure that they comply with the drawings and specifications in both intent and detail. No consideration will be given to shop drawings submitted without this approval and review from the Contractor. Appendix A at the end of this section must be completed and signed and must accompany all shop drawing submissions. Submissions not accompanied by Appendix A will be returned for re-submission.
  - .4 The Departmental Representative review of these drawings is general and is not intended to serve as a check and shall not release the Contractor from responsibility for errors or from the necessity of checking the drawings themselves, or of furnishing the materials and performing the work as required by the plans and specifications.
- .4 Quality Control:
  - .1 Provide CSA certified equipment and material.

- .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
  - .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees: in accordance with General Conditions of contract.
  - .5 Submit, upon completion of Work, load balance report as described in Part 3 - Load Balance.
  - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .5 Manufacturer's Field Reports: submit to Consultant manufacturer's written report, within 3 days of review, verifying compliance of Work, as described in Part 3 - FIELD QUALITY CONTROL.

## **1.8 QUALITY ASSURANCE**

- .1 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

## **1.9 SYSTEM STARTUP**

- .1 At the conclusion of the job, the Contractor shall review and demonstrate to the Departmental Representative, all electrical equipment and their respective functions and operation. Such demonstration shall be provided for such reasonable periods of time as the complexity of the job warrants, and as approved by the Departmental Representative. Such review and demonstration shall be made by an authorized representative of the Contractor, who shall be fully knowledgeable of the project, its installation and operation. Three bound maintenance and operational manuals shall be reviewed and left with the Departmental Representative. These manuals shall be custom written for materials and systems supplied for this project. Generic information may accompany the manuals but must only be supplemental information. These manuals shall include, but not be limited to, training lists, final inspection report(s) from the authority having jurisdiction, approved copies of all shop drawings, guarantees, manufacturers maintenance instructions, diagrams, and parts lists, all packaging and installation instructions, and all operating instructions. Where manufacturers' literature is not available, or appropriate, the Contractor shall provide same in written form. This shall apply particularly to the general light, power and control system. Refer also to Section 01 11 00 – General Requirements. Prior to final inspection, submit these manuals to the Departmental Representative for review.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

**1.10 MINIMUM STANDARDS**

- .1 All work shall be performed in accordance with CSA C22.1 and NBC as minimum standards. These standards together with all Local or Municipal Rules, Regulations, and Ordinances shall be considered as the Latest Approved Editions at the time of Tender Closing. In no instance, shall the standard established by the drawings and specifications, be reduced by any codes.

**1.11 PERMITS, FEES AND INSPECTION**

- .1 The Contractor shall obtain all inspections and permits required by all laws, ordinances, rules, and regulations by public authority having jurisdiction in this district, and shall obtain certificates of such inspections and shall pay all charges in connection therewith. The final certificate of inspection shall be obtained before final payment for work shall be considered due.
- .2 In no instance shall the standard established by the drawings and specification be reduced by any codes, etc.

**1.12 SUPERVISION**

- .1 The Contractor shall provide supervision and sufficiently qualified foreman to ensure that the job proceeds in a proper and efficient manner. If in the opinion of the Departmental Representative, such personnel are not competent to carry out their work, the Contractor shall replace these men immediately upon written request of the Departmental Representative.

**1.13 OTHER TRADES**

- .1 The Contractor shall co-operate and investigate with other trades to make maximum use of the spaces and avoid conflict with pipes, ducts, equipment radiation, etc. Shop drawings shall be prepared by the Contractor indicating the route of main conduits and ducts which shall be submitted to the Departmental Representative for review.
- .2 The Contractor shall co-operate with other Contractors on the site and carry out the work, in such a way, as not to hinder or hold-up the work of other trades.
- .3 The Contractor shall consult with other Contractors, where their respective installations conflict and shall re-route conduits, ducts, outlets, equipment, etc., as required, subject to the approval of the Departmental Representative.
- .4 The Contractor shall obtain from the mechanical and other trades complete detailed wiring diagrams of equipment requiring connections and shall be responsible for pointing out any discrepancies or the reason why they cannot be adhered to.

**1.14 FIRE PENETRATIONS**

- .1 Where conduits and cables pass through fire separations and sound rated separations, including floors, walls, membranes, etc., provide a metallic sleeve, or core drill to 25.4mm radius larger than the conduit or cable passing through the fire separation. Construct a ceramic fibre insulation dam, or dams as required, and fill the penetration with fire rated putty or 3m chalk. A minimum depth of 51mm of putty or caulk is required. Installation shall be in strict accordance with manufacturers' recommendations and to suit UL and/or ULC requirements. All such work shall be performed by personnel familiar and experienced with this type of work.

**1.15 GUARANTEE**

- .1 The Contractor shall guarantee all work, under this Division, free from defects, for a period of one (1) year, after final acceptance of the entire project. The Contractor shall make good all defects, other than normal wear and tear, during the life of the guarantee. Notwithstanding the above, longer guarantees may be required for specific installations or equipment, as indicated in other sections of the specifications.
- .2 Guarantees shall be submitted in writing, bound where more than one is required, and submitted to the Departmental Representative for review. Each guarantee shall include:
  - .1 Project name and address.
  - .2 Guarantee time period (commencement date shall be the date as shown on the project final certificate of completion, unless otherwise indicated).
  - .3 Clear and concise definition of what is guaranteed.
  - .4 Signatures of company officers of the Contractor and/or manufacturers, as applicable.

**1.16 RECORD DRAWINGS**

- .1 One (1) set of white prints will be provided for record drawing purposes. Maintain project "as-built" record drawings and accurately record significant deviations from the Contract Documents, caused by site condition or Contract change. Mark changes on white prints in "RED".
- .2 Identify each drawing in the lower right hand corner in letters at least 12.7mm high as follows:
  - .1 "AS-BUILT DRAWINGS"
  - .2 (This drawing has been revised to show electrical systems as installed)
  - .3 (Signature of Contractor)
  - .4 (Date).
- .3 Submit as-built drawings to Departmental Representative for approval. Make all corrections as directed.
- .4 Prior to start of testing, balancing and adjusting, finalize production of as-built drawings.
- .5 Testing, balancing and adjusting to be performed using as-built drawings.
- .6 Turn over the as built drawings to the owner at the completion of the project.

**PART 2 PRODUCTS**

**2.1 MATERIALS AND EQUIPMENT**

- .1 Contract materials shall be new and CSA approved for their specific use.
- .2 For the purposes of uniformity similar materials shall be of one manufacturer (i.e. all panels and switchgear; all motor control equipment; all light fixtures in as much as is possible; etc.)
- .3 To avoid the possibility of the work being delayed, the Contractor shall order all materials as soon as possible, and he shall report at once to the Departmental Representative any delays in the delivery of materials which would hold up the completion of the job.
- .4 "Approved Manufacturers" catalogue designations are included in portions of this specification and also on the drawings. Manufacturers and equipment not listed, are not

acceptable. Requests for approval of alternatives to the equipment specified, may be submitted to the Departmental Representative for consideration ten (10) days prior to Tender closing. Where such approvals are granted, the Contractor shall assume full responsibility for the use of alternates with respect to conformance with the specifications, and physical limitations incurred.

## 2.2 WARNING SIGNS

- .1 Warning Signs: As specified and in accordance with requirements of Electrical Inspection Department and Departmental Representative.
- .2 Decal signs, minimum size 178mm x 2.54mm.

## 2.3 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

## 2.4 EQUIPMENT IDENTIFICATION

- .1 All panelboards, disconnect switches, transformers, etc. are to be provided with "lamicoid" nameplates as further described herein. Care is to be taken to ensure that all plates are affixed true and level, and plumb in all instances.
- .2 Nameplates are to be affixed to all "metal" surfaces with steel type "pop-rivets". Care shall be taken to ensure that rivets do not interfere with the operation of the equipment.
- .3 Nameplates are to be affixed to other types of surfaces with contact type cement.
- .4 Nameplates are to be affixed to building "exterior" surfaces with nylon inserts and self tapping screws unless specifically indicated otherwise.
- .5 Contact type cement is to be applied (buttered) to complete rear side of plate, as opposed to several locations or areas on same
- .6 Lamicoid nameplates installed on distribution panelboards, motor control centres, splitter troughs, transformers, etc. shall indicate the following:
  - .1 Designated name of equipment.
  - .2 Amperage of overcurrent protection device.
  - .3 Voltages, number of phases and wires.
  - .4 Designation of power source

.1 Example:

PANEL 101 – 150AMPS 120/208V–3PH–4W FED FROM MAIN SWITCHBOARD
---

- .7 Lamicoid nameplates installed on disconnect switches, etc. shall contain the following information.
  - .1 Designated name of equipment.
  - .2 Designated name of power source.
  - .3 Branch circuit breaker number(s) where possible.
  - .4 Voltage(s).
    - .1 Example:

EXHAUST FAN NO. 1  
PANEL H – 120V  
CCT. NO.17

- .8 Lamicoid nameplates installed on fusible type disconnect switches are to also indicate maximum designated/designed fuse size.
- .9 Lamicoid nameplates are to be installed on all junction and/or pull boxes sized 152.4mm x 152.4mm and larger indicating name of system, designated panel name and electrical characteristics where applicable.
- .10 Lamicoid nameplates are to be installed adjacent to each overcurrent devices located in switchboards, CDP panels, etc.. They need only indicate designated name and/or number of equipment they feed. Unused O.C. devices are to be identified as spare(s). Provide new lamicoïd nameplates for all existing breakers in the main switchboard and existing 120/208V distribution panelboard.
- .11 Lamicoid nameplates installed on “main” service entrance switches, or “main” entrance switchboards to indicate the following information on minimum size 152.4mm x 2plate complete with two lines of 12.7mm high lettering. (Size #8 nameplate.)

.1 Example:

MAIN BREAKER 600 AMPS  
100% RATED  
347/600V-3PH-4W

- .12 Install an additional “lamicoïd” nameplate on all, or any piece of electrical equipment, or apparatus (i.e.: main switchboard, CDP panels, panelboards, motor control centres, etc.) that may contain overcurrent devices, i.e. circuit breakers and/or fuses, that have been designed for, and incorporate interrupting capacity sized “larger” than 10 kcalC.

.1 Examples:

Minimum interrupting capacity of breakers  
installed in this panel to be not less than 20  
kcalC.

Minimum interrupting capacity of fuses  
installed in this MCC to be not  
less than 20 kcalC.

- .13 Allow for an “average” of forty letters for each lamicoïd nameplate.
  - .1 Lamicoïd 3.175mm thick plastic engraving sheet, black letters, white face, for all electrical systems except fire alarm systems which shall have white letters on red face.
  - .2 1.59mm thick nameplates above receptacles as previously indicated, with top left and right corners to be rounded off.
  - .3 Lettering on lamicoïd nameplates shall not “start” or “end” nearer than 9.525mm from either, or both ends of said plates. Size of lettering, including overall lengths of various plates shall be as indicated in the following chart.
  - .4 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10mm x 51mm	1 line	5mm high letters
Size 2	13mm x 76mm	1 line	6mm high letters
Size 3	16mm x 76mm	2 lines	5mm high letters
Size 4	19mm x 89mm	1 line	10mm high letters
Size 5	38mm x 89mm	2 lines	13mm high letters
Size 6	25mm x 102mm	1 line	13mm high letters
Size 7	38mm x 102mm	2 lines	6mm high letters
Size 8	51mm x 152mm	2 lines	13mm high letters

- .14 Labelling of all branch circuit phase and neutral conductors to be done on both ends of all circuit conductors plus in “all” junction and/or pull boxes located in between. Use write-on, self-laminating labels sized as necessary. To be installed in a “flagged” manner around individual conductor(s).
- .15 Coverplates for junction and/or pull boxes located above finish ceilings housing branch circuits are to have each branch circuit number neatly identified on coverplate. Felt marker-pen may be used for this purpose.
- .16 All of the following conductors are to have their insulation colours identified as indicated:

Phase A	Red
Phase B	Black
Phase C	Blue
Neutral	White/Grey
Bond	Green
Ground	Green
Isolated Ground	Green c/w Yellow Strip

- .1 Colour code conductor insulation and others as per the following:
  - .1 All sizes of phase conductors up to and including #2 AWG.
  - .2 All sizes of neutral, bond and/or ground conductors, up to and including #3/0 AWG.
- .2 Approved coloured tapes in lieu of insulation colouring may be used to identify conductors that exceed sizes as indicated in items .16.1.1 and .16.1.2 above, and is to take place on both ends of runs for a minimum of 30.5mm from where terminations take place.
- .17 Bonding conductors require labelling on both ends of runs where they are “dedicated” solely to the designated branch circuit they accompany. Identify with same number(s) being used to identify accompanying branch circuit phase and neutral conductor.
- .18 All junction and/or pull boxes, conduit fittings (and covers), etc., complete with their respective coverplates are to be colour coded as per the following. Boxes are to be coloured both inside and outside, where “one” colour only is required. Boxes are to be coloured on inside only where “two” colours are required. Metal coverplates are to have both colours applied diagonally where “two” colours are required. Complete plate is to be painted where one colour only is required.

- .19 All various systems concealed junction and/or pull boxes located within ceiling spaces are to have their locations identified on room side of T-bar grid spline or access cover frames with appropriate colour coded, circular shaped, self adhering discs. Discs are to be both, 19mm and 6mm in diameter, as described in the following legend, with 6mm discs being centred in the middle of 3/4" discs. Concealed junction, pull and/or outlet boxes, conduit fittings, etc., in ceiling spaces complete with their respective metal coverplates.
- .20 A legend of colour coding used is to be provided under plexiglass and located in the main electrical room, 915mm x 610mm minimum size frame.
- |                     |           |          |
|---------------------|-----------|----------|
| Various Systems     | 19mm Disc | 6mm Disc |
| .1 241 to 600 volts | Orange    |          |
| .2 51 to 240 Volts  | Yellow    |          |
| .3 Ground or Bond   | Green     |          |
- .21 Schedules shall be installed on the back of each door for panels, neatly arranged and mounted in frame under transparent cover. Schedules shall show system voltage, which outlets are on each circuit and any special information necessary. Schedules shall be typewritten and of a permanent nature.

**2.5 WIRING IDENTIFICATION**

- .1 Identify wiring on both ends of phase conductors of feeders and branch circuit wiring by circuit number at all panelboards, pull and junction boxes, outlet and equipment connections, and all devices. Labels shall be Panduit PLD-1 or PLD-2 as required. Labels to be installed in such a manner as to present white area with information in "flagged" position. Wrap around conductor in "U" fashion and have it adhere to itself. Identify neutrals and bond wires indicating which circuits with which they are used.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 The individual conductors and conductor pairs used in the various communications cables shall be colour coded. Maintain the colour coding scheme for each system throughout.

**2.6 CONDUIT AND CABLE IDENTIFICATION**

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15.25m intervals.
- .3 Colours: 25mm wide prime colour and 19mm wide auxiliary colour.
- |    |                   |        |           |
|----|-------------------|--------|-----------|
|    | System            | Prime  | Auxiliary |
| .1 | up to 250V        | Yellow |           |
| .2 | up to 251 to 600V | Orange |           |

**2.7 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .1 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do underground systems in accordance with CSA C22.3 No.7 except where specified otherwise

#### **3.2 NAMEPLATES AND LABELS**

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

#### **3.3 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to the pouring of concrete, laying of concrete block, and the installation of drywall partitions.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

#### **3.4 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Panelboards: 1.83m to top as required by Code or as indicated.

#### **3.5 MOTOR AND EQUIPMENT CONNECTIONS**

- .1 Provide final connections to all motors, equipments, controls, etc. indicated on the drawing. These motors, equipment, controls, etc. shall include those supplied under other sections of this specification, as well as Departmental Representative supplied items. Ensure that equipment will operate properly (e.g. proper rotation) and report any instance of defective equipment to the Departmental Representative.

#### **3.6 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 This contractor shall adjust overcurrent devices as directed by the Consultant.
- .2 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

### 3.7 FIELD QUALITY CONTROL

- .1 Load Balance:
  - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment. Such adjustments shall be made under normal load conditions.
  - .3 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests:
  - .1 Power distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .4 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
    - .2 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.
- .3 Check resistance to ground before energizing.
- .4 Test all wiring included in the Contract, to ensure there are no shorts or grounded conductors and that insulation values are as required by the CSA C22.1.
- .5 The Engineer reserves the right to use any piece of electrical equipment, device, or material installed under this Contract for such reasonable lengths of time and at such times as they may require to make a complete and thorough test of the same, before the final completion and acceptance of the work
- .6 The following wiring methods detailed below are designed to enhance the ability to perform capacitive leakage tests; these methods are to be strictly followed and tests performed under this Contract
  - .1 All circuit conductors are to be individually tie wrapped to their corresponding labelled neutral conductor in all panelboards, pull boxes and junction boxes. Enough slack conductor length should be left to enable the ability to clamp the ground detector around the individually tie wrapped circuit conductor and its corresponding labelled neutral. This wiring method is to be neat and of good workmanship quality
  - .2 The tie wrapping of the neutral with its respective phase conductors is to be made at the closest point of entry into panelboards, pull boxes and junction boxes.
  - .3 The main switchboard, CDP's, panelboards, MCC's, etc. are to have their respective feeder phase and neutral conductors tie wrapped together and enough slack conductor length to enable the ability to clamp the ground detector around each set of feeders. This wiring method is to be neat and of good workmanship quality. The main electrical switchboard is to have each of its sub-

- feeder phase conductors tie wrapped together with each respective neutral. This tie wrapping is to be located such that ease of clamping the ground detector can be accomplished without excessive exposure to live bus.
- .4 After all electrical wiring has been completed by the Electrical Sub-Contractor, he is to test the grounded electrical distribution system to ensure there are not ground shorts, and capacitive leakage in the system is within acceptable limits
  - .5 All feeders or branch circuits, which do not have neutral conductors, are to have their respective phase conductors tie wrapped together in accordance with the methods described previously.
  - .7 Submit properly prepared and bound reports of all tests indicating:
    - .1 The date and time of the test.
    - .2 The name or names of those who conducted the test.
    - .3 The purpose of the test.
    - .4 The results of the test.
    - .5 Any applicable code limits or bounds.
  - .8 Such tests shall not be construed as evidence of acceptance of any part of the Contract, and it is agreed and understood that no claim for damage will be made for any injury or breakage to any part or parts of the above, due to the aforementioned tests, where caused by weakness or inaccuracy of parts, or by defective materials or workmanship of any kind whatsoever.
  - .9 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
  - .10 Manufacturer's Field Services:
    - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
    - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
    - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

### **3.8 CLEANING**

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .3 On completion of this project, the Contractor shall remove all debris and leave the site neat and tidy. Equipment shall be checked for proper fitting and alignment, adjusted, cleaned, repainted where necessary, and left in first class condition.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials and installation procedures for wire and box connectors (0-1000V).

**1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA):
  - .1 CSA C22.2 No. 18.4-2015 (R2019), Hardware for the Support of Conduit, Tubing, and Cable.
  - .2 CSA C22.2 No. 65-2018, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC):
  - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA).

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 11 00 – General Requirements.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Mechanical pressure type wire connectors to: CSA C22.2 No. 65, with current carrying parts of copper or copper alloy, sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No. 65, with current carrying parts of copper or copper alloy sized to fit copper conductors #10 AWG or less.
- .3 Bushing stud connectors to: EEMAC 1Y-2 and NEMA shall consist of:
  - .1 Connector body and stud clamp for stranded round copper conductors.
  - .2 Clamp for stranded round copper conductors.
  - .3 Stud clamp bolts.
  - .4 Bolts for copper conductors.
  - .5 Sized for bars ampacity ratings.
- .4 Clamps or connectors for armoured cable, TECK cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CSA C22.2 No. 18.4

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.
    - .1 Joints required in branch circuit wiring #10 AWG and smaller shall be made using twist-on wire-nut connectors, #31, #33, or #35 as required. Twist-on wire-nut connectors shall be “plier-tightened”, finger-tight is not acceptable. Insulating cap is to completely cover all conductors.
    - .2 Joints for all other wiring shall be made using compression type connectors. Insulation shall consist of a first layer of compound tape followed by a layer of vinyl electrical tape. Insulating tapes shall overlap successive wraps by a minimum of 50%.
  - .2 Install fixture type splice connectors and tighten to CSA C22.2 No. 65. Replace insulating cap.
  - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2 or NEMA.
- .2 All connections shall be made electrically and mechanically secure. The sizes of connectors shall be according to manufacturer's recommendations for each wire size and combination of wires.

END

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials and installation procedures for wire and cables (0-1000V).

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 20 – Wire and Box Connectors (0-1000V).
- .3 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.
- .4 Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts.
- .5 Section 33 71 73.02 – Underground Electrical Service.

**1.3 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA):
  - .1 CSA C22.1-2021, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.2 No. 38-2018, Thermoset-Insulated Wires and Cables.
  - .3 CSA C22.2 No. 51-2014 (R2018), Armoured Cables.
  - .4 CSA C22.2 No. 131-2017, Type TECK 90 Cable.

**1.4 ACTION AND INFORMATIONAL SUBMITALLS**

- .1 Provide product data in accordance with Section 01 11 00 – General Requirements.

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 11 00 – General Requirements.
- .2 Fold up metal banding, flatten and place in designated area for recycling.

**PART 2 PRODUCTS**

**2.1 BUILDING WIRES**

- .1 Wire and cable to: to CSA C22.2 No. 38.
- .2 Conductors: stranded for #10 AWG and larger. Minimum size: #12 AWG for circuits exceeding 50 volts to ground.
- .3 Conductors of soft drawn copper of 98% conductivity, rated at 600 volts unless otherwise indicated, with RW90 insulation of chemically cross-linked thermosetting polyethylene (XLPE) material rated accordingly.
- .4 Neutral conductor insulated for 600V shall be continuous with no fuses, switches, or breaks of any kind. The neutral conductor for 120V receptacle circuits shall be #10 AWG for common neutral application. Where separate neutrals are installed for each circuit, the neutral shall match the current carrying capacity of the supply conductor.
- .5 Minimum bond wire is to based upon Table 16 of the CSA C22.1. In no instance shall the bonding conductor installed for any systems be smaller than #12 AWG.
- .6 Wiring for specialized systems such as fire alarm and public address, structured cabling, Multi-media, etc. Shall be indicated in other sections or on drawings shall be indicated in other sections or on drawings.

.7 Conductor Insulation shall be colour coded as follows:

Phase A	Red
Phase B	Black
Phase C	Blue
Neutral	White/Grey
Ground	Green
Bond	Green

All phase conductors up to and including #1 AWG shall have appropriate coloured insulation.

Neutral, ground and/or bond wires shall have appropriate coloured insulation on all sizes up to and/or including #3/0 AWG. Approved colour coded tapes in lieu of coloured insulation may be used on sizes other than indicated above minimum 30.5 mm of tape.

.1 Isolated ground – Green with Yellow stripe.

.2 Where extra colours are required for three way switches, they shall be Yellow

.8 Grounding and bonding conductors sized up to and including #10AWG, are to have green colour RW90 X-link insulation. Type TW75 complete with green coloured insulation if acceptable for all sizes #8 AWG and larger.

.9 The voltage drop in no case shall exceed 3% of the line volts for 15A, 120V branch circuits. The following table shall be used:

Branch Circuit Run from Panel to Load including Vertical Drops	Branch Circuit Conductor Size	Dedicated Neutral Size	Common Neutral Size	Bond Wire Size
24.4 M	#12	#12	#10	#12
24.5 M – 38.1 M	#10	#10	#8	#12
38.2 M – 56.4 M	#8	#8	#6	#10

.10 Oversized #10 AWG branch circuit wiring conductors to be extended to outlet box of device they feed. Oversized #8 AWG branch circuit wiring conductors to be extended from panelboard to junction box located on wall or ceiling directly above receptacles. #8 AWG wire to be reduced to #10 AWG for vertical portion of drop only.

.11 Voltage drop calculation: distance is measured to the last device along the conductor run.

**2.2 TECK CABLE**

.1 Cable: to CSA C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Chemically cross-linked polyethylene XLPE, rated 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

- .2 Channel type supports for two or more cables at 1500 mm centers.
- .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
  - .1 Watertight, approved for TECK cable.

### **2.3 ARMoured CABLES**

- .1 Cable: to CSA C22.2 No. 51.
- .2 Conductors: insulated, aluminium, size as indicated.
- .3 Type: ACWU90, PVC flame retardant jacket over armour and suitable for direct burial.
- .4 Armour: interlocking type fabricated from galvanized steel strip.
- .5 Connectors: watertight, approved for ACWU90 cable.

## **PART 3 EXECUTION**

### **3.1 GENERAL CABLE INSTALLATION**

- .1 Install cables in trenches in accordance with Section 33 71 73.02 – Underground Electrical Service.
- .2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors (0-1000V).
- .3 Cable Colour Coding: to Section 26 05 00 – Common Work Results for Electrical.
- .4 Conductor length for parallel feeders to be identical.
- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

### **3.2 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.
  - .2 In underground ducts in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts.
- .2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors (0-1000V).
- .3 The tye-wrapping of the neutral conductor with its respective phase conditions is to be made at the closet point of entry “within” all panelboards, pull boxes, junction boxes and outlet boxes, etc.
- .4 All branch circuits which do not have neutral conductors, are to have their respective phase conductors tye-wrapped together in accordance with previously described methods.

**3.3 INSTALLATION OF TECK CABLE**

- .1 Install cables, securely supported by straps and/or hangers.
  - .1 Group cables wherever possible on channels.
- .2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors (0-1000V).

**3.4 INSTALLATION OF ARMOURED CABLES**

- .1 Install cables in accordance with manufacturer's instructions and CSA C22.1.
  - .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors (0-1000V).
  - .1 Do not terminate with a copper bodied connector.
  - .2 Apply oxide coating on base cables.
- .3 All types of "armoured" cables are to be installed concealed, parallel and perpendicular to building lines and shall be adequately secured to the building structure at not less than 1500 mm intervals or as otherwise indicated, in such manner as to ensure they are protected from potential types of mechanical damage occurring. Install independent supports for cabling in ceiling spaces and do not use those of other trades. Do not secure cables to mechanical systems piping, ducts, or suspended ceiling support wires. The laying of "un-supported" cables atop ceiling grids is strictly prohibited.

**3.5 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials and installation procedures for primary grounding system.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical.

**1.3 REFERENCE STANDARDS**

- .1 Institute of Electrical and Electronics Engineers (IEEE):
  - .1 IEEE 837-2014, Standard for Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association (CSA):
  - .1 CSA C22.1-2021, Canadian Electrical Code, Part 1 (25<sup>th</sup> Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.2 No. 0.4-2017, Bonding of Electrical Equipment.

**1.4 ACTION AND INFORMATIONAL SUBMITALLS**

- .1 Submit shop drawings and product data in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, physical size, finish and limitations.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Rod electrodes: copper clad steel, 19 mm diameter by 3 m long.
- .2 Conductors: bare, stranded, soft annealed copper wire, size as indicated for ground bus, electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections.
- .3 Conductors: PVC insulated coloured green, stranded, soft annealed copper wire, size #4 AWG for grounding cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers.
- .4 Accessories: non-corroding, necessary for complete grounding system, including:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Thermit welded type conductor connectors.
  - .5 Bonding jumpers, straps.
  - .6 Pressure wire connectors.

- .5 Wire connectors: compression, sized to fit copper conductors, as follows:
  - .1 Ground loop connector for copper cables. Acceptable manufactures:
    - .1 Burndy.
    - .2 Erico.
    - .3 Thomas & Betts.
  - .2 Compression ground rod to loop connector:
    - .1 Burndy.
    - .2 Erico.
    - .3 Thomas & Betts.
  - .3 Compression top connector for copper ground conductors:
    - .1 Burndy.
    - .2 Erico.
    - .3 Thomas & Betts.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install continuous grounding system including, electrodes, conductors, connectors and accessories in accordance with CSA C22.1, CSA C22.2 No. 0.4 and requirements of local authority having jurisdiction.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to electrodes, structural steel work, using compression connectors to IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Use #8 AWG bare copper cable for main ground bus connection to grounding rods.
- .7 The main incoming ground conductor is run to the main electrical service entrance.

#### **3.2 ELECTRODE INSTALLATION**

- .1 Install ground rod electrodes. Make grounding connections to equipment.
- .2 Install ground rod electrodes at location indicated on site plan.
- .3 Make special provision for installing electrodes that will give acceptable resistance to ground value, where rock or sand terrain prevails.

#### **3.3 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical building equipment including:
  - .1 Non-current carrying parts of: transformers, generators, motors, circuit breakers, reclosers, current transformers, frames of gang operated switches and fuse cut-out bases.

- .2 Cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers.
- .3 Meter and relay cases.
- .4 Any exposed building metal, within or forming part of station enclosure.
- .5 Outdoor lighting.
- .2 Ground hinged doors to main frame of electrical equipment enclosure with flexible jumper.

### **3.4 NEUTRAL GROUNDING**

- .1 Connect transformer neutral and distribution neutral together using insulated conductor to one side of ground test link, the other side of the test link being connected directly to main station ground. Ensure distribution neutral and neutrals of potential transformers and service banks are bonded directly to transformer neutral and not to main station ground.
- .2 Interconnect electrodes and neutrals at each grounding installation.
- .3 Connect neutral of station service transformer to main neutral bus with tap of same size as secondary neutral.
- .4 Ground transformer with continuous conductor from ground lug through connector on ground bus to primary neutral. Connect neutral bushing at transformer to primary neutral in same manner.

### **3.5 POLE MOUNTED TRANSFORMER GROUNDING**

- .1 Drive ground rods at base of each pole on which transformers are installed on and interconnect transformer, system neutral, lighting arrestors and ground rods.

### **3.6 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Engage an independent testing agent to inspect grounding and perform ground resistance test before backfill.
- .3 Perform earth loop test and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction.
- .4 Perform test and submit result and inspection certificate to Consultant before energizing electrical system.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials and installation procedures for secondary grounding system.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical.

**1.3 REFERENCE STANDARDS**

- .1 Institute of Electrical and Electronics Engineers (IEEE):
  - .1 IEEE 837-2014, Standard for Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA):
  - .1 CSA C22.1-2021, Canadian Electrical Code, Part 1 (25<sup>th</sup> Edition), Safety Standard for Electrical Installations.

**1.4 ACTION AND INFORMATIONAL SUBMITALLS**

- .1 Submit shop drawings and product data in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, physical size, finish and limitations

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 11 00 – General Requirements.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

**PART 2 PRODUCTS**

**2.1 EQUIPMENT**

- .1 Insulated grounding conductors: green, type RW90.
- .2 Wire connectors: compression, sized to fit copper conductors.

- .3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Thermit welded type conductor connectors.
  - .5 Bonding jumpers, straps.
  - .6 Pressure wire connectors.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run bond wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install separate ground conductor to outdoor lighting standards.
- .8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .10 All bond wires are to be twisted together with a twist-on wire-nut connector and then placed in the rear of the outlet box in such a manner as to minimize obstructions.
- .11 All cables, feeder, and branch circuit conductors installed in conduit are to be complete with a separate minimum size #12 solid AWG copper bond wire sized in accordance with CSA C22.1 Table 16.

#### **3.2 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

#### **3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials, components and installation procedures for splitters, junction, pull boxes, and cabinets.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical.

**1.3 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA):
  - .1 CSA C22.1-2021, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.2 No. 40-17(2017), Junction and Pull Boxes.
  - .3 CSA C22.2 No. 85-14(R2018), Rigid PVC Boxes and Fittings.
  - .4 American National Standards Institute (ANSI).

**1.4 ACTION AND INFORMATIONAL SUBMITALLS**

- .1 Submit shop drawings and product data for cabinets in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .2 Fold up metal banding, flatten and place in designated area for recycling.

**PART 2 PRODUCTS**

**2.1 JUNCTION BOXES**

- .1 To CSA C22.2 No. 40, and CSA C22.2 No. 85 where exterior.
- .2 Construction:
  - .1 Sheet metal with all welded steel corners and screw-on flat covers for surface mounting, interior use.
  - .2 CSA 4X for outdoor use, manufactured of PVC in a gray colour analogous to rigid PVC.
- .3 Where larger than standard boxes use:

- .1 Type D for boxes up to 305 mm square; and
- .2 Type C for boxes larger than 305 mm square.
- .4 All flush installed boxes shall be Type D. Covers for flush mounted pull boxes shall extend a minimum of 25 mm all around.
- .5 Concealed junction boxes (within ceiling space) shall not be smaller than 102 mm square.

## **2.2 CABINETS**

- .1 Construction: sheet steel with all welded steel corners, hinged door, handle, latch, lock, two (2) keys and catch.
- .2 Type E Empty: surface return flange, flush overlapping sides, for surface mounting.
- .3 Type T Terminal: surface return flange, flush overlapping sides, for surface mounting, containing 19 mm G1S plywood backboard.

## **2.3 PULL BOXES**

- .1 Pull Boxes are to be minimum 457mm deep, fiberglass construction, ANSI tier 8 load rating. Standard of acceptance:
  - .1 Hubbell: FRP Box

## **PART 3 EXECUTION**

### **3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations and secure them adequately to the building structure. Pull boxes installed in the middle of conduit runs without backing are not acceptable.
- .2 The location of junction and/or pull boxes in suspended ceiling spaces, e.g. drywall, T-Bar, etc., is not to be greater than 750 mm above the finished ceiling and must be easily accessible.
- .3 All suspended junction, pull and outlet boxes shall be supported with minimum size 9.5 mm threaded rods, nuts and flat washers. Threaded rods shall be secured to boxes with one flat washer and nut installed on both sides of box. One rod required for all boxes sized up to and including 120 mm square. Two rods required for boxes larger than 120 mm square, up to and including 204 mm square. A minimum of four rods required for all boxes larger than 204 mm square.
- .4 Mount cabinets with top not higher than 2 m above finished floor.
- .5 Install terminal block as indicated in Type T cabinets.
- .6 Only main junction and pull boxes are indicated. Install additional pull boxes as not to exceed 30 m of conduit run between pull boxes, and as required by CSA C22.1.

**3.2 IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Identification labels: Install size 2, indicating system name, voltage and phase.
- .3 All junction and pull boxes coverplates are to be colour coded.
- .4 Concealed junction and pull boxes installed above ceilings or behind walls, are to have their locations identified on room sides of access opening frames with properly coloured coded identification discs.
- .5 Coverplates for junction and pull boxes located above finished ceilings housing branch circuits shall have each branch circuit number neatly identified on plate. Felt marker may be used for this purpose.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials and installation procedures of conduits, conduit fastenings and conduit fittings for electrical equipment and systems.

**1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA):
  - .1 CSA C22.1-2021, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.2 No. 18.3-2012 (R2017), Conduit, Tubing, and Cable Fittings.
  - .3 CSA C22.2 No. 18.4-2015 (R2019), Hardware for the Support of Conduit, Tubing, and Cable.
  - .4 CSA C22.2 No. 45.1-2007 (R2017), Electrical Rigid Metal Conduit - Steel.
  - .5 CSA C22.2 No. 56-2017, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .6 CSA C22.2 No. 83-M1985 (R2017), Electrical Metallic Tubing.
  - .7 CSA C22.2 No. 211.2-2006 (R2016), Rigid PVC (Unplasticized) Conduit.

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .2 Fold up metal banding, flatten and place in designated area for recycling.

**PART 2 PRODUCTS**

**2.1 CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No. 45.1, galvanized steel threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid PVC Conduit: to CSA C22.2 No. 211.2
- .4 Flexible metal conduit: to CSA C22.2 No. 56, aluminum and liquid-tight flexible metal.

**2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 53 mm and smaller. Two hole steel straps for conduits larger than 53 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1500 mm on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

**2.3 CONDUIT FITTINGS**

- .1 Fittings: to CSA C22.2 No. 18.3 and CSA C22.2 No. 18.4, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degree bends are required for 27 mm and larger conduits.

- .3 Couplings and connectors EMT shall be set-screw type or watertight. Connectors for conduits sizes 41 mm and large shall be complete with threaded plastic bushings. Connectors for conduits sizes smaller than 41 mm shall be complete with insulated throats
- .4 Connectors for flexible conduit and armoured cable shall be set-screw steel. Locknuts shall be case hardened.
- .5 Connectors for liquid tight flexible conduit shall be watertight, compression type galvanized steel or aluminum. Locknuts shall be case hardened. Dry type connectors may be used in dry indoor areas not exposed to liquids or moisture, if approved for use.

## **2.4 FISH CORD**

- .1 Polypropylene.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms, and in unfinished areas.
- .3 Install conduits to avoid proximity to steam and hot water pipes by 150 mm.
- .4 Conduits shall run through ceiling spaces and down in walls. No conduit shall run in floor slabs unless specifically indicated.
- .5 Use electrical metal tubing (EMT) for all work, unless otherwise indicated, for panelboard feeders, branch circuit wiring, etc., and where not installed underground.
- .6 All conduits shall be securely held in place by means of approved supports and in accordance with CSA C22.1. All EMT conduit straps shall be steel, cast straps are not acceptable.
- .7 Securely fasten EMT in place within 900 mm of each outlet box, junction box, cabinet, coupling or fitting, and the maximum spacing between supports shall be as follows:
  - .1 1.5 m for 16 mm and 21 mm EMT.
  - .2 2.1m for 27 mm and 35 mm EMT.
  - .3 3 m for 41 mm EMT and larger
- .8 Rigid PVC conduits shall be used in all poured concrete construction.
- .9 Use rigid PVC conduit underground.
- .10 Use flexible metal conduit for connections between lighting fixtures and their respective junction boxes, and where rigid EMT conduit cannot be used, such as in cabinet work.
- .11 Use liquid tight flexible metal conduit for connections transformers, motors and equipment in both wet and dry areas.
- .12 Conduit shall not pass through structural members without the permission of the Consultant.
- .13 Conduits shall be continuous, and shall be made electrically and mechanically secure throughout.

- .14 Minimum conduit size for lighting and power circuits: 16 mm.
- .15 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .16 Mechanically bend steel conduit over 21 mm diameter.
- .17 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .18 Install fish cord in empty conduits.
- .19 Run three 27 mm spare conduits up to ceiling space from each flush panel. Terminate these conduits in 152 mm x 152 mm x 102 mm junction boxes in ceiling space.
- .20 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .21 Dry conduits out before installing wire.

### **3.2 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

### **3.3 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

### **3.4 CONDUITS UNDERGROUND**

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.
- .3 Install a minimum 600 mm below finished grade, unless indicated otherwise.

### **3.5 COUPLINGS AND CONNECTORS**

- .1 Threaded couplings shall be used for all rigid steel threaded conduit joints. All joints in or below concrete slabs shall be thoroughly red leaded and screwed tight. No exposed threads shall be left, i.e., running thread couplings are not approved. Ericson couplings are approved.
- .2 Rigid steel threaded conduit shall connect to boxes and cabinets with the use of two case hardened steel locknuts and insulated bushing. Painted area at locknut connections shall be scraped clean, and locknuts screwed tight to ensure ground continuity.
- .3 EMT couplings shall be securely tightened.
- .4 Connectors for EMT, liquid tight and flexible conduit or cable shall terminate at boxes and cabinets with one case hardened locknut. Painted area shall be scraped clean, and locknut screwed tight to ensure ground continuity.

- .5 Watertight connectors and couplings shall be used for exposed vertical runs of EMT. Set-screws are not acceptable for exposed vertical runs.
- .6 Couplings and connectors for rigid PVC shall be cleaned with solvent and joined with cement CSA approved for the purpose.

**3.6 CONDUIT FITTINGS**

- .1 Install conduit fittings where required. Secure conduit in fittings and secure conduit to structure within 305 mm of fitting.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Installation procedures of cables in trenches and in ducts.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results for Electrical.

**1.3 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA).

**PART 2 PRODUCTS**

**2.1 CABLE PROTECTION**

- .1 38 mm x 140 mm planks, pressure treated with water repellent preservative.

**2.2 MARKERS**

- .1 Warning tape: 78 mm wide with words "CAUTION ELECTRIC LINES BURIED BELOW"  
Warning tape shall be made of non-biodegradable polyethylene film.

**PART 3 EXECUTION**

**3.1 DIRECT BURIAL OF CABLES**

- .1 After sand bed is in place, lay cables maintaining 78 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
- .2 Provide offsets for thermal action and minor earth movements. Offset cables 78 mm for each 61 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Underground cable splices are not acceptable.
- .4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .5 Cable Separation:
  - .1 Maintain 78 mm minimum separation between cables of different circuits.
  - .2 Maintain 305 mm horizontal separation between low and high voltage cables.
  - .3 When low voltage cables cross high voltage cables maintain 305 mm vertical separation with low voltage cables in upper position.
  - .4 At crossover, maintain 78 mm minimum vertical separation between low voltage cables and 152 mm between high voltage cables.
  - .5 Maintain 305 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
  - .6 Install treated planks on lower cables 610 mm in each direction at crossings.

- .6 After sand protective cover is in place, install continuous row of overlapping pressure treated planks, interlocking cable blocks as indicated to cover length of run.

### **3.2 CABLE INSTALLATION IN DUCTS**

- .1 Install cables as indicated in ducts.
  - .1 Do not pull spliced cables inside ducts.
- .2 Install multiple cables in duct simultaneously.
- .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .4 To facilitate matching of colour coded multi-conductor control cables reel off in same direction during installation.
- .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non leaded cables with moisture seal tape.
- .6 After installation of cables, seal duct ends with duct sealing compound.
- .7 Install in each empty duct, 6 mm stranded polypropylene pull rope continuous throughout with 1000 mm spare rope at each end.
- .8 Cap all spare ducts.

### **3.3 MARKERS**

- .1 Mark cables continuous along cable/duct runs with warning tape.

### **3.4 FIELD QUALITY CONTROL**

- .1 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .2 Check phase rotation and identify each phase conductor of each feeder.
- .3 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .4 Tests:
  - .1 After installing cable but before terminating, perform insulation resistance test with 1000 V megger on each phase.
  - .2 Check insulation resistance after each termination to ensure that cable system is ready to be energized.

**END OF SECTION**

**Part 1 General**

**1.1 SECTION INCLUDES**

- .1 Materials, components and installation procedures for dry type transformers up to 600V primary.

**1.2 RELATED SECTIONS**

- .1 None.

**1.3 REFERENCES**

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
  - .1 CSA C22.2 No. 47-13 (R2018), Air-Cooled Transformers (Dry Type).
  - .2 CSA C9-17, Dry-Type Transformers.
  - .3 CAN/CSA-C802.2-18 Minimum Efficiency Values for Dry-Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA) latest edition of the following
  - .1 NEMA ST 20-2014, Dry Type Transformers for General Applications.

**1.4 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with General Conditions of Contract and all other associated sections.
- .2 Shop Drawings:
  - .1 Indicate materials, finish, dimensions and installation details.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Provide operation and maintenance data for dry-type transformers for incorporation into manual specified in General Conditions of Contract and all other associated sections.
- .2 Operation and maintenance instructions to include:
  - .1 Tap changing.
  - .2 Recommended environmental conditions.
  - .3 Recommended periodic inspection and maintenance.

**Part 2 Products**

**2.1 MANUFACTURERS**

- .1 Subject to compliance with requirements, provide products by the following:
  - .1 Hammond
  - .2 Eaton
  - .3 Siemens
  - .4 Delta
  - .5 REX

**2.2 TRANSFORMERS**

- .1 Dry-type transformers: to CAN/CSA-C22.2 No.47, CSA-C9, and CSA C802.2. Use transformers of one manufacturer throughout project.
- .2 Characteristics, Design 1 – General Purpose:
  - .1 Type: ANN.

- .2 Rating: as indicated on drawings, 3 phase, 60 Hz.
- .3 220 degrees C insulation class, 150 degrees C temperature rise.
- .4 Impedance:
  - .1 Up to 150 kVA: 4 - 6.5%.
  - .2 225 - 300 kVA: 4 - 8 %.
- .5 Primary and secondary coils: Copper.
- .6 Primary winding: 600V, delta, BIL 10kV.
- .7 Secondary winding: 208/120V, wye, BIL 10kV, four wire with neutral brought out and grounded.
- .8 Sound rating: to CSA C9, NEMA ST 20.
- .9 Voltage taps: 4-2.5%, 2-FCAN, 2-FCBN.
- .10 Enclosure:
  - .1 Sheet steel fabrication.
  - .2 CSA Type 1 c/w sprinkler hoods.
  - .3 Bolted removable panels for access to tap connections and enclosed terminals.
  - .4 Designed for floor mounting for all sizes. Designed for wall or floor mounted for sizes up to 50 kVA.
  - .5 Indoor, ventilated self-cooled type. Temperature of exposed metals parts no to exceed 65 degrees C rise.
  - .6 Finish: ANSI 61 light grey.

### **2.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Equipment labels: nameplate size 7.
- .3 Nameplate wording: Transformer No., Source, Equipment fed.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Locate, install and ground transformers as indicated and in accordance with manufacturer's instructions.
- .2 Mount transformers up to 50 kVA as indicated. Floor mounted transformers shall be mounted on a concrete housekeeping pad.
- .3 Mount transformers above 50 kVA on floor, on a concrete housekeeping pad.
- .4 Housekeeping pad shall be rigid, plumb and square to build floor and wall(s), 150mm larger than the outside dimensions of the equipment they support, not less than 100mm thick, and be complete with chamfered edges.
- .5 Ensure adequate clearance around transformer for ventilation, locate units at least 150mm from adjacent walls and/or structures.
- .6 Set and secure transformers in place, rigid plumb and square. Loosen isolation pad bolts until no compression is visible.

- .7 Make primary and secondary connections in accordance with wiring diagram. Use flexible conduit to make connections to transformer.
- .8 Energize transformers after installation is complete.

**3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 The following tests shall be performed as standard on all transformers:
  - .1 Ratio tests at the rated voltage connection and at all tap connections.
  - .2 Polarity and phase relation tests on the rated voltage connection.
  - .3 Applied potential tests.
  - .4 Induced potential test.
  - .5 No-load and excitation current at rated voltage on the rated voltage connection.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials for moulded-case circuit breakers.

**1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA):
  - .1 CSA C22.2 No. 5-2016, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 22 kA symmetrical (rms) and over at system voltage.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- .1 Breakers shall be compatible with panelboards supplied under Washroom Building contract and shall meet the kA ratings as indicated.

**2.2 BREAKERS GENERAL**

- .1 Moulded-case circuit breakers, and accessory high-fault protectors: to CSA C22.2 No. 5.
- .2 Ground-fault circuit-interrupter breakers: refer to Section 26 28 20 – Ground Fault Circuit Interrupters.
- .3 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 °C ambient.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
  - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Common-trip breakers: with single handle for multi-pole applications. Tie-bars are not permitted.
- .6 The use of plug-in moulded-case circuit breakers is not permitted.
- .7 The use of “mini” type circuit breakers is not permitted.

- .8 Extension handles are to be provided for all breakers rated 225 A and larger.

### **2.3 THERMAL MAGNETIC BREAKERS**

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

### **2.4 SOLID STATE TRIP BREAKERS**

- .1 Moulded-case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous, tripping for phase, and ground fault short circuit protection.
- .2 Main breaker for service entrance board shall be solid-state, rated for 100% current carrying capacity.
- .3 All breakers 400 A and large shall be solid state.

### **2.5 OPTIONAL FEATURES**

- .1 Included, as indicated.
  - .1 Shunt trip.
  - .2 Auxiliary switch.
  - .3 Motor-operated mechanism.
  - .4 Under-voltage release.
  - .5 On-off locking device.
  - .6 Handle mechanism.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install circuit breakers.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials and installation procedures for direct buried underground cable ducts.

**1.2 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA):
  - .1 CSA C22.2 No. 211.1-206 (R2016), Rigid Types EB1 and DB2.ES2 PVC Conduit.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4 QUALITY ASSURANCE**

- .1 Quality assurance submittals: submit following in accordance with Section 01 11 00 – General Requirements.
  - .1 Certificates: signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
  - .2 Manufacturer's Instructions: for installation and special handling criteria, installation sequence and cleaning procedures.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 11 00 – General Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management in accordance with 01 11 00 – General Requirements.

**PART 2 PRODUCTS**

**2.1 PVC DUCTS AND FITTINGS**

- .1 Rigid PVC duct: to CSA No. 211.1, type DB2/ES2, with moulded fittings, for direct burial.
  - .1 Nominal length: 6 m plus or minus 12 mm.
- .2 Rigid PVC split ducts.
- .3 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make a complete installation.

- .4 Rigid PVC 90 degrees, 45 degrees bends and 5 degrees angle couplings as required.
- .5 Expansion joints every 30 m and as required.

## **2.2 SOLVENT WELD COMPOUND**

- .1 Solvent cement for PVC duct joints.

## **2.3 CABLE PULLING EQUIPMENT**

- .1 6 mm stranded nylon pull rope tensile strength 5 kN.

## **2.4 MARKERS**

- .1 Warning Tape: non-biodegradable polyethylene film, 76 mm wide, yellow with black letters, imprinted with "CAUTION BURIED ELECTRIC CABLE BELOW.

## **PART 3 EXECUTION**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 INSTALLATION**

- .1 Install pipe in accordance with manufacturer's instructions and at elevations as indicated.
- .2 Clean inside of ducts before laying.
- .3 Install plastic duct spacers and ensure full, even support every 1.5 m and smooth transition throughout duct length.
- .4 Slope ducts with 1 to 400 minimum slope.
- .5 Install plugs and cap both ends of ducts to prevent entrance of foreign materials during and after construction.
- .6 Pull through each duct steel mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign material.
  - .1 Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .7 Install a pull rope continuous throughout each duct run with 3 m spare rope at each end.
- .8 Place continuous strip of warning tape 300 mm above duct before backfilling trenches.
- .9 Notify the Consultant for field review upon completion of direct buried ducts and obtain acceptance prior to backfill.

### **3.3 CLEANING**

- .1 Clean in accordance with Section 01 11 00 – General Requirements.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials and installation procedures for the underground electrical service.

**1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 21 – Wires and Cables (0-1000V).
- .2 Section 26 05 28 – Grounding - Secondary.
- .3 Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts.

**1.3 REFERENCE STANDARDS**

- .1 None.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 11 00 – General Requirements: Submittal Procedures.

**1.5 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Perform Work to comply with the applicable Provincial/Territorial regulations.
  - .2 Coordinate and meet the requirements of the power supply authority.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Conductors: aluminium type ACWU90, size and number of conductors as indicated, in accordance with Section 26 05 21 – Wires and Cables (0-1000V).
- .2 Backfill: clean and free of debris.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Install cables in trenches and in ducts in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts.
- .2 Allow adequate conductor length for connection to service equipment.
- .3 Make grounding connections in accordance with Section 26 05 28 – Grounding - Secondary.
- .4 Seal ducts and conduits at building entrance location after installation of cable.

**3.2 CLEANING**

- .1 Clean in accordance with Section 01 11 00 – General Requirements.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 11 00 – General Requirements.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Section 01 33 00 - Submittal Procedures.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM D 4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

### **1.3 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Allow continual sampling by Departmental Representative during production.
- .3 Provide Departmental Representative with access to source and processed material for sampling.
- .4 Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.
- .5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
- .6 Provide water and electric power to Departmental Representative laboratory trailer at production site as requested.

### **1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert unused granular materials from landfill to load facility to satisfaction of Departmental Representative.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances
-

that would act in deleterious manner for use intended.

- .2 Flat and elongated particles of coarse aggregate: to ASTM D 4791.
  - .1 Greatest dimension to exceed five times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
  - .1 Natural sand.
  - .2 Manufactured sand.
  - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be crushed rock:
  - .1 Gravel or crushed gravel will not be acceptable.
  - .2 River or beach gravels will not be acceptable.
  - .3 Salt water submerged deposits will not be acceptable.

## **2.2 SOURCE APPROVAL AND QUALITY CONTROL**

- .1 Source(s) of materials to be incorporated into work or stockpiled to be to satisfaction of Departmental Representative.
  - .2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling within four (4) weeks of commencing production.
  - .3 If, in opinion of Departmental Representative, materials from 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 Advise Departmental Representative four (4) weeks in advance of any change in material source to allow sampling, testing and approval.
  - .5 The Contractor will pay all costs associated with sampling, testing, and approval of any material source change made after approval of the initial source.
  - .6 Acceptance of 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.
-

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- .1 Aggregate source preparation
    - .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials, including existing asphalt. Dispose of cleared, grubbed and unsuitable materials to the satisfaction of the Departmental Representative.
    - .2 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
    - .3 When excavation is completed, dress sides of excavation to nominal 1:1 slope, and provide drains or ditches as required to prevent surface standing water.
    - .4 Trim off and dress slopes of waste material piles and leave site in neat condition.
  - .2 Processing
    - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
    - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment to the satisfaction of Departmental Representative.
    - .3 Wash aggregates, if required to meet specifications. Use only equipment satisfactory to Departmental Representative.
    - .4 When operating in stratified deposits, use excavation equipment and methods that produce uniform, homogeneous aggregate.
  - .3 Handling
    - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
  - .4 Stockpiling
    - .1 Stockpile aggregates on site in locations as directed by Departmental Representative. Do not stockpile on completed pavement surfaces.
    - .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
    - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
    - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
    - .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
    - .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 h
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- of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
    - .1 Max 1.5 m for coarse aggregate and base course materials.
    - .2 Max 1.5 m for fine aggregate and sub-base materials.
    - .3 Max 1.5 m for other materials.
  - .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
  - .9 Do not cone piles or spill material over edges of piles.
  - .10 Do not use conveying stackers.
  - .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

### **3.2 CLEANING**

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.
- .3 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

## PART 1 - GENERAL

### 1.1 RELATED SECTIONS

- .1 Section 01 35 43 - Environmental Procedures.

### 1.2 REFERENCES

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

## PART 2 – PRODUCTS

Not applicable.

## PART 3 - EXECUTION

### 3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Inspect, repair, and maintain erosion and sedimentation control measures during construction until stabilization has been established.
- .2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal when approved by Departmental Representative.

### 3.2 STRIPPING OF TOPSOIL

- .1 Ensure that procedures are conducted in accordance with applicable federal, provincial and municipal requirements.
  - .2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
  - .3 Handle topsoil only when it is dry and warm.
  - .4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by alternative disposal.
  - .5 Remove brush from targeted area by no chemical means and dispose of through alternative disposal.
  - .6 Strip topsoil to satisfaction of Departmental Representative.
    - .1 Avoid mixing topsoil with subsoil.
-

- .7 Pile topsoil in berms in locations as directed by Departmental Representative.
- .8 Stockpile height not to exceed 2 m.
- .9 Dispose of unused topsoil as directed by Departmental Representative and in accordance with all applicable federal, municipal and provincial regulations.
- .10 Protect stockpiles from contamination and compaction.
- .11 Cover topsoil that has been piled for long term storage with anchored waterproof and insulated tarps, as required to resist wind, water and winter conditions. Place straw bales around the stockpile to filter sediment entering or exiting the pile.

### **3.3 PREPARATION OF GRADE**

- .1 Verify that grades are correct and notify Departmental Representative if discrepancies occur. Do not begin work until instructed by Departmental Representative.
  - .1 Grade area only when soil is dry to lessen soil compaction.
  - .2 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

### **3.4 PLACING OF TOPSOIL**

- .1 Place topsoil only after Departmental Representative has accepted subgrade.
- .2 Spread topsoil during dry conditions in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
- .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .4 Cultivate soil following spreading procedures.

### **3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM D 698-12e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12400 ft - 1bf/ ft<sup>3</sup> (600 KN-m/m<sup>3</sup>)).

### **1.3 EXISTING CONDITIONS**

- .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
- .2 Refer to dewatering in Section 31 23 33.01 - Excavating Trenching and Backfilling.

### **1.4 PROTECTION**

- .1 Protect existing fencing, trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain. If damaged, restore to original or better condition unless directed otherwise by Departmental Representative.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Selected Backfill Material: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## **PART 3 - EXECUTION**

### **3.1 STRIPPING OF TOPSOIL**

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Departmental Representative.
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- .2 Commence topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush, weeds and grasses and removed from site.
- .3 Strip topsoil to depths as directed by Departmental Representative. Avoid mixing topsoil with subsoil.
- .4 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m.
- .5 Dispose of unused topsoil off site, as directed by Departmental Representative.

### **3.2 GRADING**

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as directed by Departmental Representative.
- .2 Rough grade to depths as indicated. Proof roll exposed subgrade.
- .3 Slope rough grade away from building as indicated.
- .4 Grade ditches to depth required for maximum run-off as indicated.
- .5 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.
- .6 Do not disturb soil within branch spread of trees or shrubs to remain.

### **3.3 PROOF ROLLING**

- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with center to center spacing of 730 mm maximum.
  - .2 Obtain approval from Departmental Representative to use nonstandard proof rolling equipment.
  - .3 Proof roll at level in subgrade as indicated. If nonstandard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
  - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
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- .5 Where proof rolling reveals areas of defective subgrade:
  - .1 Remove subgrade material to depth and extent as directed by Departmental Representative.
  - .2 Backfill excavated subgrade in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **3.4 STOCKPILING**

- .1 Pile excavated fill, suitable for re-use as approved by Departmental Representative, in locations as directed by Departmental Representative.
  - .1 Stockpile height not to exceed 2 m.
- .2 Protect stockpiles from contamination and compaction.
- .3 Cover fill that has been piled for long term storage with anchored water proof and insulated tarps, as required, to resist wind, water and winter conditions. Place straw bales around the stockpile to filter sediment entering or exiting the pile.

### **3.5 TESTING**

- .1 Quality control testing shall be conducted and paid for by Contractor. Submit results of quality control testing to Departmental Representative for review when requested. Quality assurance inspection and testing will be carried out by a third party designated by the Departmental Representative. Costs of these tests will be paid by Departmental Representative.

### **3.6 SURPLUS MATERIAL**

- .1 Remove surplus material and material unsuitable for fill, grading or landscaping off site to satisfaction of Departmental Representative.

END

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## **PART 1 - GENERAL**

### **1.1 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Standards Certification:
  - .1 Construction Waste Management: submit copy of Waste Management Plan for project highlighting recycling and salvage requirements
  - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 50% of construction wastes were recycled or salvaged.
  - .3 Erosion and Sedimentation Control: submit copy of Erosion and Sedimentation Control Plan for project highlighting implementation measures.

### **1.2 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Packaging Waste Management: remove for reuse and return to manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Materials and Resources Credit MRc2.1 Construction Waste Management: Divert 50% From Landfill: prepare Construction Waste Management plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and 01 78 00 - Closeout Submittals.

## **PART 2 - PRODUCTS**

Not applicable.

## **PART 3 – EXECUTION**

### **3.1 ROCK REMOVAL**

- .1 Perform excavation in accordance with Erosion and Sedimentation Control Plan.
  - .2 Co-ordinate this Section with Section 01 35 29.06 - Health and Safety Requirements .
  - .3 Remove rock to alignments, profiles, and cross sections as indicated.
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- .4 Explosive blasting is not permitted.
- .5 Use rock removal procedures to produce uniform and stable excavation surfaces.
- .6 Minimize over-break to avoid damage to adjacent structures.
- .7 Excavate rock to horizontal surfaces with slope not to exceed slope indicated.
- .8 Final finished surface to be approved by Departmental Representative.
- .9 Prepare rock surfaces which are to bond to concrete, by scaling, pressure washing and broom cleaning surfaces.
- .10 Excavate trenches to lines and grades to minimum of 150 mm below pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.
- .11 Cut trenches to widths as indicated.
- .12 Use pre-shearing or other smooth wall drilling techniques unless specified otherwise or directed by Departmental Representative.
- .13 Remove boulders and fragments which may slide or roll into excavated areas.
- .14 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **3.2 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Rock Disposal:
  - .1 Dispose of surplus removed rock off site as indicated in accordance with Section 01 74 21 - Construction/demolition Waste Management and Disposal.
  - .2 Do not dispose removed rock into landfill. Send material to appropriate quarry location as approved by Departmental Representative.
- .1 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.3 PROTECTION**

- .1 Prevent damage to surroundings and injury to persons in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

END

## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 31 22 13 - Rough Grading.
- .3 Section 32 11 16.01 - Granular Sub-Base.
- .4 Section 32 11 23 - Aggregate Base Courses.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C 117-13. Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C 136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D 422-63(2007), Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D 698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
  - .5 ASTM D 4318-10e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Prince Edward Island Department of Transportation and Infrastructure Renewal
  - .1 Standard Specification

### **1.3 DEFINITIONS**

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
  - .1 Rock: solid material in excess of 1.00 m<sup>3</sup> and which cannot be removed by means of heavy-duty mechanical excavating equipment. Frozen material not classified as rock.

- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
  
- .2 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.
  
- .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
  
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
  
- .5 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
  
- .6 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 D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.2.
    - .2 Table: Sieve Designation % Passing 2.0 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.
  
- .7 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.

#### **1.4 SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
  
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control:
  - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
  - .2 Submit for review by Departmental Representative proposed dewatering and heave prevention methods as described in PART 3 of this Section.
  - .3 Submit to Departmental Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.

- .4 Submit to Departmental Representative written notice when bottom of excavation is reached.
- .5 Submit to Departmental Representative testing inspection results and report as described in PART 3 of this Section.
- .3 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.
  - .3 Submit 70 kg samples of type of fill specified including representative samples of excavated material
  - .4 Ship samples prepaid to Departmental Representative, in tightly closed containers to prevent contamination and exposure to elements.

## **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert excess aggregate materials from landfill to local quarry recycling facility for reuse as directed by Departmental Representative.

## **1.6 EXISTING CONDITIONS**

- .1 Buried services:
  - .1 Contractor is responsible to confirm the locations of existing utilizes, such as water, sewer, gas, electrical, telephone, and other underground utilities as necessary as required by the respective utility owner.
  - .2 Contractor to process and provide clearance to dig permit. Clearance to dig permit to be provided by and available from Contractor.
  - .3 Maintain copies of the approved clearance to dig permit and associated drawings on site during the work. Ensure all workers, trades and sub-contractors are aware of existing utilities.
  - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .5 Prior to beginning excavation Work, notify, Departmental Representative and applicable authorities having jurisdiction establish location and state of use of buried utilities and structures. Ensure such locations are clearly marked to present disturbance during work.
  - .6 Confirm locations of buried utilities by careful test excavations methods.
  - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as directed by Departmental Representative.
  - .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing re-routing or otherwise disturbing utilities or structures. Pay Costs for such work.

- .9 Record location of maintained, re-routed and abandoned underground lines.
- .10 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Class A Gravel to Division 400 of PEITIR Standard Specification – General Provisions and Contract Specifications for Highway and Bridge Construction (2016).
- .2 Class B Gravel to Division 400 of PEITIR Standard Specification - General Provisions and Contract Specifications for Highway and Bridge Construction (2016).
- .3 Drainage Class D clear stone to Division 400 of PEITIR Standard Specification - General Provisions and Contract Specifications for Highway and Bridge Construction (2016).
- .4 Selected Backfill Material: from excavation or other sources, approved by the Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sod, refuse, debris and other deleterious materials.
- .5 Unshrinkable Fill: proportioned and mixed to provide:
  - .1 Maximum compressive strength of 1.0 MPa at 28 days.
  - .2 Maximum cement content of 25 kg/m<sup>3</sup> to CSA-A3001, Type GU.
  - .3 Minimum strength of 0.07 MPa at 24 h.
  - .4 Concrete aggregates: to CSA A23.1/A23.2.
  - .5 Cement: Type GU.
  - .6 Slump: 160 to 200 mm.

### **2.2 UNDERGROUND UTILITY WARNING TAPE**

- .1 Plastic warning tape colour coded and labeled for the type of services to be installed below it, 150 mm and 75 mm widths, heavy duty polyethylene colour coded as follows:
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- .1 Colour Orange; wording CAUTION: BURIED CABLE TV LINE BELOW.
- .2 Colour Red; wording CAUTION: BURIED ELECTRICAL BELOW, 150 mm wide for primary and 75 mm wide for secondary.
- .3 Colour Yellow; wording CAUTION: BURIED GAS LINE BELOW.
- .4 Colour Green; wording CAUTION: BURIED SEWER LINE BELOW.
- .5 Colour Orange; wording CAUTION: BURIED TELEPHONE BELOW.
- .6 Colour Blue; wording CAUTION: BURIED WATERLINE BELOW.
- .7

### **PART 3 - EXECUTION**

#### **3.1 SITE PREPARATION**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits as directed by Departmental Representative.
- .2 Saw cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

#### **3.2 PREPARATION/PROTECTION**

- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures 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 satisfaction of Departmental Representative.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise directed by Departmental Representative 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.

#### **3.3 STRIPPING OF TOPSOIL**

- .1 Begin topsoil stripping of areas as directed by Departmental Representative. After area has been cleared of vegetation and removed from site.
- .2 Strip topsoil to satisfaction of Departmental Representative.
  - .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed and to satisfaction of Departmental Representative.

- .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .4 Dispose of unused topsoil as directed by Departmental Representative and in accordance with all applicable federal, municipal and provincial regulations.

### **3.4 STOCKPILING**

- .1 Stockpile fill materials in areas designated by Departmental Representative.
  - .1 Stockpile granular materials in manner to prevent segregation.
  - .2 Protect fill materials from contamination.
  - .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

### **3.5 DEWATERING**

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative's review approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Protect open excavations against flooding and damage due to surface run-off.
- .4 Dispose of water in accordance with applicable federal, municipal and provincial regulations and in manner not detrimental to public and private property, or portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .5 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

### **3.6 EXCAVATION**

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Health and Safety Act for the Province of Prince Edward Island.
  - .2 Excavate to lines, grades, elevations and dimensions as indicated.
  - .3 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation.
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- .4 Excavation must not interfere with bearing capacity and normal 1:1 (H:V) splay of adjacent foundations.
- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain.
- .6 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .7 Keep excavated and stockpiled materials safe distance away from edge of trench.
- .8 Restrict vehicle operations directly adjacent to open trenches.
- .9 Dispose of surplus and unsuitable excavated material offsite in accordance with applicable federal, municipal and provincial regulations.
- .10 Do not obstruct flow of surface drainage or natural watercourses.
- .11 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .12 Obtain Departmental Representative approval of completed excavation.
- .13 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .14 Correct unauthorized over-excavation as follows and to satisfaction of Departmental Representative:
  - .1 Fill under bearing surfaces and footings with Type 1 Gravel compacted to not less than 98% of Standard Proctor maximum dry density.
  - .2 Fill under other areas with Selected Backfill Material compacted to not less than 95 % of Standard Proctor maximum dry density.
- .15 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.

### **3.7 FILL TYPES AND COMPACTION**

- .1 Use types of fill and compaction specified below unless indicated otherwise on drawings. Compaction densities are percentages of maximum densities obtained from ASTM D 698.
  - .1 Under pavement areas: Select Backfill Material compacted to not less than 98% of Standard proctor maximum dry density. Lifts not to exceed 150mm compacted thickness.
  - .2 Under landscape areas: Select Backfill Material compacted not less than

95% of Standard proctor maximum dry density. Lifts not to exceed 150 mm compacted thickness.

- .3 Under sidewalks/pathways:
  - .1 Use Type 4 fill to underside of base course. Compact to 95% of maximum dry density.
  - .2 Use Type 1 fill to underside of sidewalk/pavement. Compact to 100% of maximum dry density.

### **3.8 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

### **3.9 BACKFILLING**

- .1 Vibratory compaction equipment: as required to achieve specified compaction throughout layer. Lighter equipment to be used immediately adjacent structures.
- .2 Do not proceed with backfilling operations until completion of following:
  - .1 Departmental Representative has inspected and approved installations.
  - .2 Departmental Representative has inspected and approved of construction below finish grade.
  - .3 Inspection, testing, approval, and recording location of underground utilities.
  - .4 Removal of concrete formwork.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 200 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer. Thinner layers will be required where light compaction equipment is required.
- .6 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 hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading.

**3.10 RESTORATION**

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil and landscaping as required and to satisfaction of Departmental Representative.
- .3 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .4 Clean and reinstate areas affected by Work to Departmental Representative's satisfaction.
- .5 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END

---

## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 – Submittal procedures.
- .2 Section 01 61 00 – Common Product Requirements.
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

### **1.2 REFERENCES**

- .1 ASTM International
    - .1 ASTM A 123/A 123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
    - .2 ASTM D 4491-15, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
    - .3 ASTM D 4595-11, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
    - .4 ASTM D 4716-14, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
    - .5 ASTM D 4751-12, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
  - .2 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-4.2 No. 11.2-2004, Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
    - .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.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
      - .4 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
      - .5 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.
  - .3 CSA International
    - .1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
-

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect geotextiles from direct sunlight and UV rays.
  - .3 Replace defective or damaged materials with new.
- .3 Packaging Waste Management: remove for reuse as specified in Construction Waste Management in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **PART 2 - PRODUCTS**

### **2.1 MATERIAL**

- .1 Geotextile: Non-woven synthetic fibre fabric, supplied in rolls.
    - .1 Width: as required for application.
    - .2 Length: as required for application.
  - .2 Physical properties:
    - .1 Silt Fence Geotextiles to PEITIR Standard Specification, Division 800, Section 806.
-

- .2 Rolled Erosion Control Product:
  - .1 Straw Fibre Double Net consisting of agricultural straw with 75% four-inch fibers or great fiber length, and certified weed seed free. Top and bottom of each blanket to be covered with green polypropylene netting containing oxo-biodegrader and UV additives.
  - .2 "C" Factor = 0.05
  - .3 Shear Stress (Unvegetated) = 0.84Pa
  - .4 Velocity (Unvegetated) = 2.1m/s
  - .5 Mass per Unit Area (+/- 10%) = 0.27 kg/m<sup>2</sup>
  - .6 Net Openings (Polypropylene) = 12.7 mm x 12.7 mm
- .3 Securing pins and washers: to CSA G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m<sup>2</sup> to ASTM A 123/A 123M.
- .4 Factory seams: sewn in accordance with manufacturer's recommendations.
- .5 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for geotextile material installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

#### **3.2 INSTALLATION**

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with.
  - .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
  - .3 Place geotextile material for silt fence in one continuous length from post to post.
  - .4 Join successive strips of geotextile by sewing.
-

- .5 Pin successive strips of geotextile with securing pins at mm interval at midpoint of lap as indicated.
- .6 Protect installed geotextile material from displacement, damage or deterioration.
- .7 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .8 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.4 PROTECTION**

- .1 Vehicular traffic not permitted directly on geotextile.

---

## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Section 31 05 16 - Aggregate Materials.
- .3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C 117-13, Standard Test Methods for Material Finer Than 75-microm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C 131-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C 136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D 422-63 (2007)e2, Standard Test Method for Particle-Size Analysis of Soils.
  - .5 ASTM D 698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
  - .6 ASTM D 1883-14, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .7 ASTM D 4318-10e1, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .8 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .9 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Prince Edward Island Department of Transportation and Infrastructure Renewal
  - .1 Standard Specification.

### **1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Divert unused granular material from landfill to local facility to the satisfaction of the Departmental Representative.
-

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Granular subbase material: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Class B Gravel to Division 400 of PEITIR Standard Specification - General Provisions and Contract Specifications for Highway and Bridge Construction (2016).

## **PART 3 - EXECUTION**

### **3.1 PLACING**

- .1 Place granular sub-base after subgrade is to the satisfaction of the Departmental Representative.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean, unfrozen surface, free from snow or ice.
- .5 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .6 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
- .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .8 Remove and replace portion of layer in which material has become segregated during spreading.

### **3.2 COMPACTION**

- .1 Compaction equipment to be capable of obtaining required material densities.
  - .2 Compact to density of not less than 100% of Maximum Dry Density in accordance with ASTM D 698.
-

- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-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 to the satisfaction of the Departmental Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

### **3.3 QUALITY CONTROL TESTING**

- .1 Inspection and testing shall be carried out by the Contractor.
- .2 Minimum Test Frequency: 1 test per 250 m<sup>2</sup>/Lift.
- .3 Submit satisfactory compaction test results to Departmental Representative for review.
- .4 Contractor shall conduct and submit satisfactory compaction test results to Departmental Representative prior to placement of subsequent materials. Payment will not be considered for placement of sub-base unless satisfactory test results are submitted to Departmental Representative.

### **3.4 SITE TOLERANCES**

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

### **3.5 PROTECTION**

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is to the satisfaction of the Departmental Representative.

## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Section 31 05 16 - Aggregate Materials.
- .4 Section 32 11 16.01 - Granular Sub-base.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C 117-13, Standard Test Methods for Materials Finer Than 75-mirco m Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C 131-14, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C 136-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D 698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
  - .5 ASTM D 1883-14, Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils.
  - .6 ASTM D 4318-10e1, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-88, Sieves, Testing, Woven Wire, Metric.
- .3 Prince Edward Island Department of Transportation and Infrastructure Renewal
  - .1 Standard Specification.

### **1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert unused granular material from landfill to local facility to satisfaction of Departmental Representative.
-

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Granular base material: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Class A Gravel to Division 400 of PEITIR Standard Specification - General Provisions and Contract Specifications for Highway and Bridge Construction (2016).

## **PART 3 - EXECUTION**

### **3.1 SEQUENCE OF OPERATION**

- .1 Place granular base after sub-base surface is to the satisfaction of the Departmental Representative.
  - .1 Placing
    - .1 Construct granular base to depth and grade in areas indicated.
    - .2 Ensure no frozen material is placed.
    - .3 Place material only on clean unfrozen surface, free from snow and ice.
    - .4 Place material using methods which do not lead to segregation or degradation of aggregate.
    - .5 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
    - .6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
    - .7 Remove and replace that portion of layer in which material becomes segregated during spreading.
  - .1 Compacting
    - .1 Compaction equipment to be capable of obtaining required material densities.
    - .2 Compact to density not less than 100% of 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 compacting to obtain specified density.
    - .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers to the satisfaction of the Departmental Representative.
    - .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
-

### **3.2 QUALITY CONTROL TESTING**

- .1 Inspection and testing shall be carried out by the Contractor.
  - .1 Minimum Test Frequency: 1 test per 250 m<sup>2</sup>/Lift.
- .2 Submit satisfactory compaction test results to Departmental Representative for review.
- .3 Contractor shall conduct and submit satisfactory compaction test results to Departmental Representative prior to placement of subsequent materials. Payment will not be considered for placement of Base Course, unless satisfactory test results are submitted by Contractor.

### **3.3 SITE TOLERANCES**

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

### **3.4 PROTECTION**

- .2 Maintain finished base in condition conforming to this Section until succeeding material is applied or is satisfactory to the Departmental Representative.

END

---

## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 35 43 – Environmental procedures.
- .3 Section 01 61 00 – Common product Requirements.
- .4 Section 01 74 11 – Cleaning.
- .5 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

### **1.2 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-15.1-92, Calcium Chloride.
- .2 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with EPA 832/R92-005 authorities having jurisdiction and Section 01 35 43 – Environmental Procedures.
- .3 Construction Waste Management:
  - .1 Submit project Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
-

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## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Water: in accordance with Departmental Representative's approval.

## **PART 3 - EXECUTION**

### **3.1 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 sediment and erosion control drawings 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.

### **3.2 APPLICATION**

- .1 Apply water with equipment approved by Departmental Representative.
- .2 Apply water with distributors equipped with means of shut-off and with spray system to ensure uniform application.

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
  - .2 Place materials defined as hazardous or toxic in designated containers.

END

---

## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 29.06 – Health and Safety Requirements.
- .3 Section 01 35 43 – Environmental Procedures.
- .4 Section 01 61 00 – Common Product Requirements.
- .5 Section 01 74 11 – Cleaning.
- .6 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .7 Section 01 78 00 – Closeout Submittals.

### **1.2 REFERENCES**

- .1 American Association of State Highway and Transportation Officials (AASHTO)
    - .1 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.
  - .2 Transportation Association of Canada
    - .1 Manual of Uniform Traffic Control Devices for Canada (Latest Edition).
  - .3 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-1.5-99, Low Flash Petroleum Spirits Thinner.
    - .2 CAN/CGSB 1.74-01, Alkyde Traffic Paint.
  - .4 Green Seal Environmental Standards (GS)
    - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
  - .5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
    - .1 Material Safety Data Sheets (MSDS).
  - .6 The Master Painters Institute (MPI)
    - .1 Architectural Painting Specification Manual - current edition.
  - .7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
    - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.
-

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 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 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
- .3 Construction Waste Management:
  - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
  - .2 Low-Emitting Materials: submit listing of paints and coatings to comply with VOC and chemical component limits or restrictions requirements.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operations and Maintenance Data: submit information on materials relative to work of this Section for inclusion in operations and maintenance manual and as follows:

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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 off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Paint:
  - .1 To MPI -EXT 2.1B, Alkyd zone/traffic marking.
  - .2 Paints: in accordance with MPI recommendation for surface conditions.
  - .3 Paints: maximum VOC limit 100 g/L to SCAQMD Rule 1113 to GS-11.
  - .4 Colour: to MPI listed, yellow, white, blue as indicated.
  - .5 Upon request, Departmental Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative reserves right to perform further tests.
- .2 Thinner: to MPI listed manufacturer.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions 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.
  - .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Pavement surface: 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: approved pressure type mobile 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.

### **3.3 TRAFFIC CONTROL**

- .1 In accordance with Section 01 35 00.06 – Special Procedures for Traffic Control and Section 01 56 00 – Temporary Barriers and Enclosures.
-

### **3.4 APPLICATION**

- .1 Pavement markings: Lay out pavement markings, to approval of Departmental Representative.
- .2 Unless otherwise approved by Departmental 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.
- .3 Apply traffic paint evenly at rate of 3 m<sup>2</sup> /L.
- .4 Do not thin paint unless approved by Departmental Representative.
- .5 Symbols and letters to dimensions indicated.
- .6 Paint lines: of uniform colour and density with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.

### **3.5 TOLERANCE**

- .1 Paint markings: within plus or minus 12 mm of dimensions indicated.
- .2 Remove incorrect markings if required.

### **3.6 CLEANING**

- .1 Existing pavement markings to be removed by mechanical grinding means as indicated. Surface preparation in accordance with new pavement markings requirements.
- .2 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.7 PROTECTION OF COMPLETED WORK**

- .1 Protect pavement markings until dry.
  - .2 Repair damage to adjacent materials caused by pavement marking application.
-

END

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## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 29 83 – Payment Procedures for Testing Laboratory Services.
- .2 Section 01 32 16.07 – Construction Progress Schedules – Bar (GANTT).
- .3 Section 01 74 11 – Cleaning.
- .4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

### **1.2 REFERENCES**

- .1 Agriculture and Agri-Food Canada
  - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
  - .1 PN1340-2005, Guidelines for Compost Quality.
- .3 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### **1.3 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 Ignition (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) (50)), and contain no toxic or growth inhibiting contaminants.
  - .4 (25) (50)), and contain no toxic or growth inhibiting contaminants.
  - .5 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 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 - SOURCE QUALITY CONTROL.
-

## **1.5 QUALITY ASSURANCE**

- .1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.

## **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

## **PART 2 - PRODUCTS**

### **2.1 TOPSOIL**

- .1 Topsoil for seeded areas: mixture of particulates, microorganisms and organic matter which provides suitable medium for supporting intended plant growth.
  - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
  - .2 Contain no toxic elements or growth inhibiting materials.
  - .3 Finished surface free from:
    - .1 Debris and stones over 50 mm diameter.
    - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
  - .4 Consistence: friable when moist.

### **2.2 SOIL AMENDMENTS**

- .1 Fertilizer:
    - .1 Fertility: major soil nutrients present in following amounts:
    - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
    - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
    - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
-

- .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
- .6 Ph value: 6.5 to 8.0.
- .2 Peatmoss:
  - .1 Derived from partially decomposed species of Sphagnum Mosses.
  - .2 Elastic and homogeneous, brown in colour.
  - .3 Free of wood and deleterious material which could prohibit growth.
  - .4 Shredded particle minimum size: 5 mm.
- .3 Sand: washed coarse silica sand, medium to coarse textured.
- .4 Organic matter: compost Category B in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .5 Limestone:
  - .1 Ground agricultural limestone.
  - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .6 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

### **2.3 SOURCE QUALITY CONTROL**

- .1 Advise Departmental Representative of sources of topsoil and manufactured topsoil to be utilized with sufficient lead time for testing.
  - .2 Contractor is responsible for amendments to supply topsoil as required.
  - .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.
  - .4 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.
    - .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.
-

## **PART 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 requirements of authorities having jurisdiction sediment and erosion control drawings 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 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### **3.2 STRIPPING OF TOPSOIL**

- .1 Begin topsoil stripping of areas as indicated after area has been cleared of brush weeds and grasses and removed from site.
- .2 Strip topsoil to depths as indicated.
  - .1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.
- .3 Stockpile in locations as directed by Departmental Representative as indicated.
  - .1 Stockpile height not to exceed 2 m.
- .4 Disposal of unused topsoil is to be in an environmentally responsible manner but not used as landfill as directed by Departmental Representative.
- .5 Protect stockpiles from contamination and compaction.

### **3.3 PREPARATION OF EXISTING GRADE**

- .1 Verify that grades are correct.
    - .1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
  - .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
-

- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
  - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
  - .2 Remove debris which protrudes more than 75 mm above surface.
  - .3 Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
  - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

### **3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL**

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.
- .3 For sodded areas keep topsoil 15 mm below finished grade.
- .4 Spread topsoil as indicated to depths indicated.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

### **3.6 FINISH GRADING**

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
  - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
  - .1 Leave surfaces smooth, uniform and firm against deep foot printing.

### **3.7 ACCEPTANCE**

- .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

### **3.8 SURPLUS MATERIAL**

- .1 Dispose of materials except topsoil not required where directed by Departmental Representative off site.
-

**3.9    CLEANING**

- .1    Proceed in accordance with Section 01 74 11 - Cleaning.
  
- .2    Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END

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## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 74 11 - Cleaning.
- .4 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .5 Section 32 91 19.13 - Topsoil Placement and Grading.

### **1.2 SCHEDULING**

- .1 Scheduling:
  - .1 Schedule sod laying to coincide with preparation of soil surface.
  - .2 Schedule sod installation when frost is not present in ground.

### **1.3 QUALITY ASSURANCE**

- .2 Qualifications:
  - .1 Landscape Contractor: to be a Member in Good Standing of Prince Edward Island Horticultural Trades Association.
  - .2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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.

## **PART 2 – PRODUCTS**

### **2.1 MATERIALS**

- .1 Number (#1) Kentucky Bluegrass - nursery sod grown from one or more Kentucky Bluegrass cultivars or Kentucky Bluegrass/Fine Fescue Sod - grown
-

- .2 from a seed mixture containing 90-95% by weight of Kentucky Bluegrass cultivars and 5-10% by weight of creeping red chewing or hard fescue cultivars.
- .3 Sod establishment support:
  - .1 Wooden pegs: 17 x 17 x 150 mm.
- .4 Water:
  - .1 Supplied by Contractor.
- .5 Fertilizer:
  - .1 To Canada "Fertilizers Act" and Fertilizers Regulations.
  - .2 Complete, synthetic, slow release with 35 % of nitrogen content in water-insoluble form.

## **2.2 SOURCE QUALITY CONTROL**

- .1 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS**

- .1 Use installers who are Member in Good Standing of Prince Edward Island Horticultural Trades Association.

### **3.2 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 Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.3 PREPARATION**

- .1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 - Topsoil Placement and Grading. if discrepancies occur, notify Departmental Representative and commence work when instructed by Departmental Representative.
-

- .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, to contours and elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site in location as directed by Departmental Representative in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.4 SOD PLACEMENT**

- .1 Ensure sod placement is done under supervision of certified Landscape Planting Supervisor.
- .2 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.
- .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 Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

### **3.5 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:
  - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
  - .2 Not less than 3-6 pegs per square metre.
  - .3 Not less than 6-9 pegs per square metre in drainage structures. Adjust pattern as directed by Departmental Representative.
  - .4 Drive pegs to 20 mm above soil surface of sod sections.

### **3.6 FERTILIZING PROGRAM**

- .1 Apply fertilize at rate recommended by soil sample test.
-

### **3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at 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 01 74 11 - Cleaning.
  - .1 Clean and reinstate areas affected by Work.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.

### **3.8 PROTECTION BARRIERS**

- .1 Protect newly sodded areas from deterioration with fence as directed by Departmental Representative.
- .2 Remove protection after inspection as directed by Departmental Representative.

### **3.9 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 to depth of 75 to 100 mm.
  - .2 Cut grass to 50 mm when or prior to it reaching height of 75 mm.
  - .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.

### **3.10 ACCEPTANCE**

- .1 Turf Grass Nursery Sod areas will be accepted by Departmental 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 have been cut minimum 2 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 When environmental conditions allow, all sodded areas showing shrinkage cracks shall be top-dressed and seeded with a seed mix matching the original.
- .4 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

**3.11 MAINTENANCE DURING WARRANTY PERIOD**

- .1 Perform following operations from time of acceptance until end of warranty period:
  - .1 Water sodded Turf Grass Nursery Sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
  - .2 Repair and resod dead or bare spots to satisfaction of Departmental Representative.

END

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## **PART 1 - GENERAL**

### **1.1 WORK INCLUDED**

- .1 In general, the work under this contract consists of, but will not necessarily be This section specifies requirements for constructing water mains and services. Work includes supply, installation and testing of pipe, fittings and service connections, and disinfection.

### **1.2 RELATED SECTIONS**

.1	Concrete	Section 03 30 00
.2	Metal Fabrications	Section 05 50 00
.3	Earthwork	Section 31 20 00
.4	Reinstatement	Section 32 98 00
.5	Precast Manholes, Catch Basins and Structures	Section 33 39 00
.6	Standard Details	Section 03 30 00

### **1.3 REFERENCE STANDARDS**

- .1 ASME B16.1-2015, Gray Iron Pipe Flanges and Standards Flanged Fittings, Class 25, 125 and 250.
- .2 ASME B18.2.1-2012, Square, Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head and Lag Screws (Inch Series).
- .3 ASTM A183-14, Standard Specification for Carbon Steel Track Bolts and Nuts.
- .4 ASTM A276/A276M-17, Standard Specification for Stainless Steel Bars and Shapes.
- .5 ASTM B62-17, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .6 ASTM B88M-18, Standard Specification for Seamless Copper Water Tube.
- .7 ASTM B418-16a, Standard Specification for Cast and Wrought Galvanic Zinc Anodes.
- .8 ASTM F876-19A, Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
- .9 ASTM F877-20, Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems.
- .10 ASTM F2023-15, Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Pipe, Tubing and Systems to Hot Chlorinated Water.
- .11 ASTM F2164-18, Standard Practice for Field Leak Testing of Polyethylene (PE)

- and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.
- .12 AWWA B300-18, Hypochlorites.
  - .13 AWWA B301-18, Liquid Chlorine.
  - .14 AWWA C104/A21.4-16, Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  - .15 AWWA C105/A21.5-18, Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - .16 AWWA C110/A21.10-12, Ductile-Iron and Gray-Iron Fittings.
  - .17 AWWA C111/A21.11-17, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - .18 AWWA C115/A21.15-11, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
  - .19 AWWA C151/A21.51-17, Ductile-Iron Pipe, Centrifugally Cast, for Water.
  - .20 AWWA C153/A21.53-19, Ductile-Iron Compact Fittings.
  - .21 AWWA C217-16, Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe and Fittings.
  - .22 AWWA C219-17, Bolted, Sleeve-Type Couplings for Plain-End Pipe.
  - .23 AWWA C223-19, AWWA Standard for Fabricated Steel and Stainless-Steel Tapping Sleeves.
  - .24 AWWA C301-14, Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
  - .25 AWWA C302-16, Reinforced Concrete Pressure Pipe, Noncylinder Type.
  - .26 AWWA C303-17, Reinforced Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
  - .27 AWWA C502-18, Dry-Barrel Fire Hydrants.
  - .28 AWWA C504-15, Rubber-Seated Butterfly Valves.
  - .29 AWWA C509-15, Resilient-Seated Gate Valves for Water-Supply Service.
  - .30 AWWA C512-15, Air Release, Air/Vacuum, and Combination Air Valves for Waterwork and Wastewater Service.
  - .31 AWWA C515-15, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
  - .32 AWWA C600-17, Installation of Ductile-Iron Water Mains and Their Appurtenances.
  - .33 AWWA C605-13, Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
  - .34 AWWA C606-15, Grooved and Shouldered Joints.
  - .35 AWWA C651-14, Disinfecting Water Mains.
  - .36 AWWA C655-18, Field Dechlorination
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- 37 AWWA C800-14, Underground Service Line Valves and Fittings.
- 38 AWWA C900-16, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In.(100mm Through 1,500mm).
- 39 AWWA C901-17, Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13mm) Through 3 In. (76mm), for Water Service.
- 40 AWWA C904-16, Cross-Linked Polyethylene (PEX) Pressure Pipe, ½ In. (13mm) Through 3 In. (76mm),for Water Service.
- 41 AWWA C906-15 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100mm Through 1,650mm), for Waterworks.
- 42 AWWA C909-16, Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe 4 In. and Larger.
- 43 CSA B137 Series-17, Thermoplastic Pressure Piping Compendium.
- 44 CAN/ULC S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- 45 NSF 14-2019, Plastic Piping Systems Components and Related Materials.
- 46 NSF 61-2019, Drinking Water System Components – Health Effects.
- 47 Prince Edward Island Department of Environment Guidelines for Monitoring Public Drinking Water Supplies.

#### **1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 10 00 for items listed in Supplementary Specifications.
- 2 For concrete pressure pipe and fittings submit tabulated materials list and drawings indicating internal pressure rating, maximum external load, type of joints and identification mark numbers.

#### **1.5 CERTIFICATE**

- .1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

#### **1.6 HANDLING AND STORAGE**

- .1 Handle and store pipe, valves, and fittings, in Storage such manner as to avoid shock and damage. Do not use chains or cables passed through pipe bore. Do not damage coatings or linings.
  - 2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.
  - 3 Store hydrants and valves to prevent retention of water and damage by freezing.
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## **1.7 SCHEDULING OF WORK**

- .1 Coordinate and organize work to minimize Work interruptions to existing services.
- 2 Notify Engineer, water utility and building occupants a minimum of 24 hours in advance of planned interruptions in service.
- 3 Do not interrupt water service except between 10:00 a.m. and 4:00 p.m. local time, unless otherwise authorized.
- 4 Notify the Fire Department of any planned or accidental interruption to water service.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- .1 Diameter, material and strength class of pipe and fittings: as indicated.
- 2 Any material that comes in contact with drinking water must comply with NSF 61. Coordinate and organize work to minimize Work interruptions to existing services.

### **2.2 POLYETHYLENE PIPE AND FITTINGS**

- .1 Pipe:
  - .1 13 to 76mm diameter: to AWWA C901.
  - 2 100mm diameter and larger: to AWWA C906
- 2 Joints:
  - .1 Thermal Butt Fusion.
  - 2 Electro-fusion coupling.
  - 3 Mechanical Connections: polyethylene flange end with metal back-up ring.
- 3 Fittings:
  - .1 Polyethylene: to AWWA C901 and AWWA C906.
  - 2 Flanged cast-iron: to AWWA C110.

### **2.3 TRACER WIRE**

- .1 RWU90, number 10 gauge (AWG), single stranded, insulated copper wire with 60mil of black cross-linked polyethylene (XCPE) insulation specifically manufactured for direct burial application or approved equivalent.
  - 2 Make all spliced or repaired wire connections in the tracer wire system waterproof using an approved buried service wire closure.
  - 3 Test stations as indicated in Project Documents.
-

## **2.4 VALVE BOXES**

- .1 Valve Boxes:
  - .1 Cast-iron, slide type, adjustable for depth of pipe below finished grade or composite valve box.
- 2 Covers marked "Water".
- 3 Lugged to prevent turning and rolling of cover, and cover notched to suit.

## **2.5 SERVICE PIPE AND FITTINGS**

- .1 Copper tubing: to ASTM B88, type K annealed, and Fittings minimum pressure rating 1035 kPa.
- 2 Polyethylene pipe: to CSA B137, AWWA C901, NSF 61, type PE, Series 160 or 200.
- 3 Cross-linked polyethylene tubing: to CSA B137 and AWWA C904, NSF 14, NSF 61, ASTM F2023, ASTM F876 and ASTM F877, type PEX.
- 4 Joints: compression type, minimum pressure rating 1035 kPa. For polyethylene pipe, to CSA B137, with stainless steel inserts.
- 5 Corporation stop: brass to ASTM B62 and NSF 61-G, compression type, inlet threads to AWWA C800.
- 6 Curb stop and drain: brass to ASTM B62 and NSF 61-G, compression type joints and O-ring seal.
- 7 Service clamp: bronze body, confined O-ring seal cemented in place and straps suitable for connecting main. Outlet tapped and threaded to AWWA C800.
- 8 Service box: adjustable type, cast-iron bottom section, cast-iron lid with recessed pentagon nut and internal stem to suit depth of bury. Service box to have appropriate foot piece.

## **2.6 COUPLINGS**

- .1 Mechanical joint sleeve type: to AWWA C110 for use on new ductile iron pipe. Provide spacer ring between pipe ends.
- 2 Grooved and shoulder type: to AWWA C606 with malleable iron housing, halogenated butyl gasket and heat treated, plated carbon steel bolts and nuts to ASTM A183.
- 3 Collar type: steel with minimum pressure rating 1035 kPa, appropriate to the type and size of pipe being joined, epoxy-coated with type 316 stainless steel bolts and nuts.

## **2.7 THRUST RESTRAINT**

- .1 Thrust blocks and anchors: 20 MPa concrete and 15 M, Grade 400 reinforcing

steel as indicated.

- 2 Mechanical joint restraint device: (100mm to 600mm) ductile iron follower gland to AWWA C153 and C111 with multiple wedge restraining mechanisms, minimum pressure working rating 2410 kPa and minimum safety factor of 2:1. Lugs to have twist-off torque nuts.
- 3 Mechanical joint restraint devices are generally to be used in combination with thrust blocks. Mechanical joint restraint devices alone are permitted on 11.25°, 22.5° and 45° horizontal bends for sizes up to 300mm diameter and in accordance with the standard detail.

## **2.8 DISINFECTANT**

- 1 Sodium hypochlorite or calcium hypochlorite: to AWWA B300.
- 2 Liquid Chlorine: to AWWA B301.

## **2.9 INSULATION**

- 1 Insulation: to ULC S701, Type 4, extruded polystyrene.

## **2.10 POLYETHYLENE ENCASEMENT**

- 1 Encasement to be 200-micron clear polyethylene tube sheet to AWWA C105.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- 1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for distribution piping installation in accordance with manufacturer's written instructions.
  - 1 Visually inspect substrate in presence of Departmental Representative.
  - 2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - 3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 PREPARATION**

- 1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.
  - 1 Inspect materials for defects to approval of Departmental Representative.
  - 2 Remove defective materials from site as directed by Departmental Representative.

### **3.3 TRENCHING**

- .1 Do trenching work in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.
- 2 Ensure trench depth allows coverage over pipe of 1.6 m or as indicated.
- 3 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.

### **3.4 GRANULAR BEDDING**

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
- 2 Do not place material in frozen condition.
- 3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- 4 Shape transverse depressions in bedding as required to suit joints.
- 5 Compact each layer full width of bed to 95% maximum density to ASTM D698.
- 6 Fill authorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling with compacted bedding material.
- .7 Testing agency to inspect and test all bedding materials and each fill or backfill layer; proceed with subsequent earthwork only after test results for previously completed work comply with requirements. Contractor to pay costs of inspection, testing, and certification.
- 8 Provide certification report from testing agency for all test results. Report to be certified by qualified Professional Engineer (licensed to practice in NB) that all work was completed in accordance with specifications.

### **3.5 SERVICE PIPE INSTALLATION**

- .1 Terminate building water service 1 m outside building wall opposite point of connection to main.
  - .1 Confirm location of water connection at building with Departmental Representative prior to installation.
  - 2 Install coupling necessary for connection to building plumbing.
  - 3 If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- 2 Lay pipes to AWWA C600 and C800 and as per manufacturer's standard instructions and specifications.
  - .1 Do not use blocks except as specified.
- 3 Do not connect service to building until satisfactory completion of hydrostatic and leakage tests of water service.

- 4 Leave corporation stop valves fully open.
  - 5 Install rigid stainless-steel liners in small diameter plastic pipes with compression fittings.
  - 6 Install curb stop with corporation box on services NPS 2 (50mm) or less in diameter.
    - .1 Equip larger services with gate valve and cast-iron box.
    - .2 Set box plumb over stop and adjust top flush with final grade elevation.
    - .3 Leave curb stop valves fully closed.
  - .7 Place temporary location marker at ends of plugged or capped unconnected water lines.
    - .1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
    - .2 Paint exposed portion of stake with designation "WATER SERVICE LINE" in blue
  - .8 Handle pipe by methods recommended by pipe manufacturer approved by Departmental Representative.
  - .9 Lay pipes on prepared bed, true to line and grade.
    - .1 Take up and replace defective pipe.
    - .2 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
  - .10 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
    - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
  - .11 Position and join pipes with equipment and methods approved Departmental Representative.
  - .12 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe and to leave smooth end at right angles to axis of pipe.
  - .13 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
  - .14 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.
  - .15 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
  - .16 Do not lay pipe on frozen bedding.
  - .17 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.
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- .18 Backfill remainder of trench.

### **3.6 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes by means of 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 Install underground post-type indicator valves as indicated.

### **3.7 HYDROSTATIC AND LEAKAGE TESTING**

- .1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
  - .2 Notify Departmental Representative at least 24 hours in advance of proposed tests.
    - .1 Perform tests in presence of Departmental Representative.
  - .3 Where 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.
  - .4 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Departmental Representative.
  - .5 Upon completion of pipe laying and after Departmental Representative has inspected work in place, surround and cover pipes between joints with approved granular material placed as directed by Departmental Representative.
  - .6 Leave valves, joints and fittings exposed.
  - .7 When testing is done during freezing weather ensure that valves, joints and fittings are protected from freezing.
  - .8 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
  - .9 Open valves.
  - .10 Expel air from main by slowly filling main with potable water.
  - .11 Thoroughly examine exposed parts and correct for leakage as necessary.
  - .12 Apply hydrostatic test pressure 1035 kPa or pressure equal to 1.5 times working pressure, whichever is greater measured, at the lowest point in the test section.
  - .13 Conduct the test over a full two (2) hour period, maintaining the constant initial test pressure.
  - .14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
  - .15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
  - .16 Repeat hydrostatic test until defects have been corrected.
-

### **3.8 PIPE SURROUND**

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
- 2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
  - .1 Do not dump material within 1000 mm.
- 3 Place layers uniformly and simultaneously on each side of pipe.
- 4 Do not place material in frozen condition.
- 5 Compact pipe bedding to at least 95% maximum density to ASTM D698.
- .6 Testing agency to inspect and test all bedding materials and each fill or backfill layer; proceed with subsequent work only after test results for previously completed work comply with requirements. Contractor to pay costs of inspection and testing.
- .7 Provide certification report from testing agency for all test results. Report to be certified by qualified Professional Engineer (licensed to practice in NB) that all work was completed in accordance with specifications.

### **3.9 BACKFILL**

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- 2 Do not place backfill in frozen condition.
- 3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698.
  - .1 In other areas, compact to at least 90% maximum density to ASTM D698.

### **3.10 FLUSHING AND DISINFECTING**

- .1 Flushing and disinfecting operations to be carried out by specialist contractor witnessed by Departmental Representative.
  - .1 Notify Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- 2 Flush water mains and water service through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.
- 3 Provide connections and pumps for flushing as required.
- 4 Open and close valves and service connections to ensure thorough flushing.
- 5 When flushing has been completed to Departmental Representative approval, introduce strong solution of chlorine as approved Departmental Representative into water service and ensure that it is distributed throughout entire system.
- .6 Specialist contractor to perform disinfection. Disinfect water mains to the

- requirements of local authority.
- .7 Rate of chlorine application to be proportional to rate of water entering pipe.
  - .8 Chlorine application to be close to point of filling water service and to occur at same time.
  - .9 Operate valves and appurtenances while main or service contains chlorine solution.
  - .10 Flush line to remove chlorine solution after 24 hours.
  - .11 Measure chlorine residuals at extreme end of pipe-line being tested.
  - .12 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
    - .1 Take samples daily for minimum of 2 days.
    - .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
    - .3 Specialist contractor to submit certified copy of test results.
  - .13 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
  - .14 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
    - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

### **3.11 SURFACE RESTORATION**

- .1 After installing and backfilling over water mains, restore surface to original condition as directed by Departmental Representative.

### **3.12 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning.
    - .1 Leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 – General Requirements: Cleaning.
  - .3 Waste Management: separate waste materials for recycling and reuse in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal.
    - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
-

END

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## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 33.01- Excavating, Trenching and Backfilling

### **1.2 REFERENCE STANDARDS**

- 1 ASTM International (ASTM)
  - .1 ASTM D2680- 01(2014), Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
- 2 CSA Group (CSA)
  - .1 CSA B1800- 15, Thermoplastic Non-pressure Pipe Compendium.
- 3 U.S. Environmental Protection Agency (EPA) / Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- 4 Materials and quality of work results shall meet or exceed the requirements PEITIR Standard Specification - General Provisions and Contract Specifications for Highway and Bridge Construction (2016), and as herein specified.
- 5 Atlantic Canada Wastewater Guidelines Manual for Collection, Treatment, and Disposal, 2006.

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling:
  - .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.
  - 2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
  - 3 Notify Departmental Representative 24 hours minimum in advance of any interruption in service.

### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Section 01 11 00 – General Requirements: Submittal Procedures.
  - 2 Product Data:
    - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and include product characteristics, performance criteria, physical size, finish and limitations.
  - 3 Shop Drawings:
-

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- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Prince Edward Island, Canada.
- 2 Indicate on drawings proposed method for installing carrier pipe or pipe sleeving if required.
- 4 Samples:
  - .1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.
- 5 Certificates:
  - .1 Certification to be marked on pipe.
- 6 Test and Evaluation Reports:
  - .1 Submit manufacturer's test data and certification 2 weeks minimum before beginning Work.
- 7 Sustainable Design Submittals:
  - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005 and authorities having jurisdiction.
- 8 Deliver, store and handle materials in accordance with Section 01 11 00 General Requirements: Common Product Requirements.
- 9 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .10 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations.
  - 2 Store and protect pipes from damage.
  - 3 Replace defective or damaged materials with new.

## **PART 2 - PRODUCTS**

### **2.1 PLASTIC PIPE**

- .1 Type PSM Polyvinyl Chloride (PVC): to CSA B1800
  - .1 Standard Dimensional Ratio (SDR): 28 unless specified otherwise.
  - 2 Bell and spigot with locked-in rubber gasket.
  - 3 Nominal lengths: 4 m.

### **2.2 PIPE BEDDING AND SURROUND MATERIALS**

- .1 Granular/Gravel bedding: in accordance with Division 400 of PEITIR Standard Specification - General Provisions and Contract Specifications for Highway and Bridge Construction (2016).
-

### **2.3 BACKFILL MATERIAL**

- .1 In accordance with 31 23 33.01 - Excavating, Trenching and Backfilling.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sewer pipe installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **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 sediment and erosion control drawings and 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.
- .2 Clean pipes and fittings of debris and water before installation and remove defective materials from site to approval of Departmental Representative.
- .3 Clean and dry pipes and fittings before installation.
- .4 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

### **3.3 TRENCHING**

- .1 Do trenching Work in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.
  - .2 Protect trench from contents of sewer or sewer connection.
  - .3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.
-

### **3.4 GRANULAR BEDDING**

- 1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
- 2 Do not place material in frozen condition.
- 3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- 4 Shape transverse depressions in bedding as required to suit joints.
- 5 Compact each layer full width of bed to 95% maximum density to ASTM D698.
- 6 Fill authorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling with compacted bedding material.
- 7 Testing agency to inspect and test all bedding materials and each fill or backfill layer; proceed with subsequent work only after test results for previously completed work comply with requirements. Contractor to pay costs of inspection, testing, and certification.
- 8 Provide certification report from testing agency for all test results. Report to be certified by qualified Professional Engineer (licensed to practice in NB) that all work was completed in accordance with specifications.

### **3.5 INSTALLATION**

- 1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
  - 2 Handle pipe using methods approved by Departmental Representative.
    - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
  - 3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
    - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
  - 4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
  - 5 Joint deflection permitted within limits recommended by pipe manufacturer.
  - 6 Water to flow through pipe during construction, only as permitted by Departmental Representative.
  - 7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
  - 8 Install plastic pipe and fittings in accordance with CSA B182.11.
  - 9 Pipe jointing:
-

- .1 Install gaskets as indicated in accordance with manufacturer's written 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 before joining.
- .4 Maintain pipe joints free from mud, silt, gravel and foreign material.
- .5 Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to 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.
- .10 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.
- .11 Plug lifting holes with pre-fabricated plugs approved by Departmental Representative, set in shrinkage compensating grout.
- .12 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.
- .13 Make watertight connections to maintenance holes.
  - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .14 Use prefabricated saddles or field connections approved by Departmental Representative for connecting pipes to existing sewer pipes.
  - .1 Joints to be structurally sound and watertight.

### **3.6 PIPE SURROUND**

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
  - .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
    - .1 Do not dump material within 1000 mm.
  - .3 Place layers uniformly and simultaneously on each side of pipe.
  - .4 Do not place material in frozen condition.
  - .5 Compact pipe bedding to at least 95% maximum density to ASTM D698.
-

### **3.7 BACKFILL**

- 1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- 2 Do not place backfill in frozen condition.
- 3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698.
  - 1 In other areas, compact to at least 90% maximum density to ASTM D698.

### **3.8 SERVICE CONNECTIONS**

- 1 Install pipe to CSA B182.11 manufacturer's instructions and specifications.
- 2 Maintain grade for 100 mm diameter sewers at 1 vertical to 50 horizontal unless indicated otherwise by Departmental Representative.
- 3 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of 4 pipe diameters.
  - 1 Use long sweep bends, unless approved otherwise.
- 4 Plug service laterals with watertight caps or plugs as approved by Departmental Representative.
- 5 Place location marker at ends of plugged or capped unconnected sewer lines (if not connected to building).
  - 1 Each marker: 38 x 89 mm stake extending from pipe end at pipe level to 0.6 m above grade.
  - 2 Paint exposed portion of stake with designation SAN SWR LINE in green.
- 6 Confirm and coordinate building connection prior to installation.

### **3.9 FIELD TESTING**

- 1 Repair or replace pipe, pipe joint or bedding found defective.
- 2 When directed by Departmental Representative, draw tapered wooden plug or mandrel 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 Perform low pressure air and maintenance hole vacuum testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.
- 5 Do low pressure air and maintenance vacuum testing as specified herein and as directed by Departmental Representative.
  - 1 Perform tests in presence of Departmental Representative.
  - 2 Notify Departmental Representative 24 hours minimum in advance of proposed tests.

- .6 Carry out tests on each section of sewer between successive maintenance holes including service connections.
- .7 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.
- .8 Repair and retest sewer line as required, until test results are within limits specified.
- .9 Repair visible leaks regardless of test results.
- .10 Television and photographic inspections:
  - .1 Carry out inspection of installed sewers by video camera, digital camera or by other related means.
  - .2 Provide means of access to permit Departmental Representative to do inspections.
- .11 Low pressure air testing:
  - .1 Locate and repair defects if test fails. Retest. Have repair method reviewed by Engineer prior to retesting.
  - .2 Repair visible leaks regardless of test results.
  - .3 **CAUTION: FOR SAFETY OF PERSONNEL AND PUBLIC, OBSERVE PROPER PRECAUTIONS DURING AIR TESTING. USE TEST EQUIPMENT DESIGNED TO OPERATE ABOVE GROUND. DO NOT PERMIT PERSONNEL IN TRENCH DURING TESTING. DO NOT AIR TEST PIPE WITH DIAMETER GREATER THAN 600 mm.**
  - .4 Provide air testing equipment meeting the following requirements:
    - .1 Air Blower: 14 litres/sec, maximum pressure 70 kPa continuous.
    - .2 Pressure Relief Valve: Sized to relieve full blower capacity at maximum blower pressure. Range 20 - 70 kPa, adjustable.
    - .3 Pressure Gauges: Range 0 to 70 kPa with accuracy +/- 0.25 kPa.
  - .5 Provide plugs at each end of section, with one plug equipped for air inlet connection.
  - .6 Fill test section slowly until a constant pressure of 28 kPa is reached. If ground water is above section being tested, Engineer may recommend increase in air pressure.
  - .7 Allow minimum 2 minutes for air temperature to stabilize, adding only amount of air required to maintain pressure.
  - .8 After 2 minute period, shut off air supply.
  - .9 Decrease pressure to 24 kPa. Measure time required for pressure to reach 17 kPa. Minimum time allowed for pressure drop is as follows:

Pipe Diameter (mm)	Minimum Time (Min:Sec)
100	1:53
150	2:50
200	3:47
250	4:43
300	5:40
375	7:05
450	8:30

### **3.10 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 11 00 – General Requirements: Cleaning.
  - .1 Leave Work area clean at end of each day.
- 2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 11 00 – General Requirements: Cleaning.
- 3 Waste Management: separate waste materials for recycling and reuse in accordance with Section 01 11 00 – General Requirements: Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

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## **PART 1 - GENERAL**

### **1.1 WORK INCLUDED**

- .1 This section specifies requirements for constructing submersible pumping stations. Work generally includes supply and installation of pumping equipment, pump controller, valves, metal fabrications, and related pipe and wet well work.

### **1.2 RELATED SECTIONS**

- |    |  |                  |
|----|--|------------------|
| .1 | Concrete:                                      | Section 03 30 00 |
| 2  | Earthwork:                                     | Section 31 20 00 |
| 3  | Sanitary Sewers:                               | Section 32 98 00 |
| 4  | Pressure Sewers:                               | Section 33 34 00 |
| 5  | Precast Manholes, Catch Basins and Structures: | Section 33 39 00 |

### **1.3 REFERENCE STANDARDS**

- .1 ANSI/ASME B16.1-2015, Class 125, Cast Iron Pipe Standards Flanges and Flanged Fittings.
- 2 ANSI/AWWA C104/A21.4-16, Cement Mortar Lining for Ductile-Iron Pipe and Fittings.
- 3 ANSI/AWWA C110/A21.10-2012, Ductile-Iron and Gray Iron Fittings for Water.
- 4 ANSI/AWWA C151/A21.51-2009, Ductile-Iron Pipe, Centrifugally Cast, for Water.
- 5 ASTM A36M-2014, Carbon Structural Steel.
- .6 ASTM A181M-2014, Carbon Steel Forgings for General-Purpose Piping.
- .7 CAN/CSA-C22.1-2015, Canadian Electrical Code.
- 8 CAN/CSA-C22.2 No. 108-2014, Liquid Pumps.
- 9 CSA Bulletin S2619-1998, Information and Documentation.

### **1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 10 00.
- 2 Indicate details of piping, valves, supports, pumps, metal fabrications, access hatches, electrical connections, and appurtenances.

### **1.5 OPERATING AND MAINTENANCE DATA**

- .1 Provide operating and maintenance data in accordance with Section 01 10 00 and as follows:
-

- .1 System description.
- .2 Design parameters, system hydraulics, design calculations, and system curves.
- .3 Performance curves for the pumps, layout, and wiring diagrams, control system schematic, level control system schematic.
- .4 Related civil, mechanical, and electrical drawings.
- .5 Manufacturer's operation instructions.
- .6 Name, address, and telephone number of equipment suppliers.
- .7 Information on guarantees and warranties.
- .8

## **1.6 HANDLING AND STORAGE**

- .1 Handle and store pumps, pipe, valves, fittings in such a manner as to avoid shock and damage. Do not use chains or cables passed through pipe or equipment. Do not damage coatings or linings.

## **1.7 MAINTENANCE MATERIAL**

- .1 Provide manufacturer's recommended spare parts list. 2
- .2 Parts to be available for use on site within 24 hours notice.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- .1 Pump characteristics, flow, head, material selection, pump model, serial number, pump curve number pump motor horsepower, rated speed, impeller materials, outlet width and pump manufacturer: as indicated in Project Document

### **2.2 PUMPS**

- .1 Submersible, non-clog or Grinder pumps.
  - .1 Equip each pump with submersible, electric motor and power supply and monitoring cable(s).
- .2 Pump unit to be capable of delivering flow and TDH, as indicated per level A of Hydraulic Institute Standard for Centrifugal Pumps unless impellers are trimmed.
  - .1 Design pump operating duty point: 38 USGPM at 18 ft TDH.
  - .2 Acceptable products: Liberty PRG100 – 1HP Submersible Grinder Pumps
- .3 Supply each unit complete with a mating, cast iron discharge connection and hot-dip galvanized lifting chain or cable, approved for overhead lifting and of adequate strength to permit raising and lowering of the pump. Lifting system shall

- be compatible with existing municipal lifting equipment.
- 4 Pump and motor close-coupled, integral design capable of handling raw, unscreened sewage. Discharge connection elbow to be permanently installed wet well, together with the discharge piping.
  - 5 Pump to be automatically connected to discharge connection elbow when lowered into place, and easily removed for inspection and service.
  - 6 Major pump components: grey cast iron, with smooth surfaces, devoid of blowholes and other irregularities.
  - 7 All exposed nuts and bolts to be 316 series stainless steel construction.
  - 8 Protect all surfaces coming into contact with sewage, other than stainless steel or brass, by an approved, sewage-resistant coating.
  - 9 Machine all mating surfaces where watertight sealing is required and fitted with nitrile or neoprene rubber O-rings. Accomplish sealing by metal-to-metal contact between machined surfaces.
  - .10 Control compression of nitrile rubber or neoprene O-rings without the requirement of a specific torque limit. Do not use secondary sealing components, rectangular gaskets, elliptical O-rings, grease or other devices or materials.
  - .11 Volute: single port, non-concentric design with smooth fluid passages, large enough at all points on the volute to pass any size solids which can pass through impeller.
  - .12 Impeller ductile iron or grey cast iron, Class 30 or better, dynamically balanced, non-clog or recessed design having a long through let without acute turns.
    - .1 Impeller: capable of handling solids, fibrous material, heavy sludge, and other matter found in normal sewage applications.
    - .2 Impeller vane design and passing sphere as indicated in Project Documents.
    - .3 Pump out vanes in the back of impeller shroud to be large enough to sufficiently expel solids away from seal area.
  - .13 Wear ring or plate system to provide efficient sealing between volute and impeller, and consist of a stationary hard metal wear system, which is fitted to volute inlet. Wear rings to be of softer construction than impellers.
  - .14 Grinder pumps to have hardened stainless shredding ring and grinder to reduce sewage to a small size for discharge through small diameter piping.
  - .15 Pumps to be rated for operation in Class 1, Zone 1 or 2 areas as specified in the Project Documents.

### **2.3 CABLE**

- .1 Power and/or control (monitoring) cable(s): neoprene-jacketed type SOW composite cable sized to meet or exceed electrical code requirements. Cable to be suitable for submerged use and CSA approved.
-

## **2.4 CABLE ENTRY**

- .1 Confirm cable entry design has an impermeable seal.
- 2 Combine power, temporary sensing and moisture sensor conductors into a single cord. Entry into the pump is accomplished by:
  - .1 Motors less than 30 HP shall furnish a plug-in power cable to allow easy changes of both voltage and cable length without motor entry.
- 3 Cable entry design must be capable of continuous submergence underwater without loss of watertight integrity to a depth of 20 m.

## **2.5 GUIDE BARS AND CABLES**

- 1 Provide corrosion resistant vertical guide bar(s) or cables with each pump to ensure correct alignment of pump with automatic discharge connection.
- 2 For each pump, guide bar(s) or cables to be as specified in the Project Documents, securely fixed at lower end to the discharge connection by means of corrosion proof bosses, provided.
- 3 Extend guide bar(s) or cables from discharge connection toward ground level to be securely fixed by a corrosion proof bracket (upper guide bar holder), anchored to the station roof.
- 4 Provide bracket with special inserts to position the guide bars rigidly, where applicable.

## **2.6 DISCHARGE CONNECTIONS**

- 1 Provide stainless steel grade 316, automatic discharge connection for each pump to connect pump to discharge piping.
- 2 Discharge connection to be permanently fixed in position by anchor bolts attached to the bottom of the pump chamber.
- 3 Discharge connections to permit rapid and precise installation or removal of the pumps without entering pump chamber.
- 4 Connection to ensure zero leakage between the pump and its discharge connection.
- 5 No part of the pump to bear directly on the floor of the wet well.

## **2.7 WETWELL VENTILATION**

- 1 In-line air intake type, with flanged connections to vent piping using stainless steel flange and bolts.
  - 2 Ventilation system to meet Canadian Electrical Code requirements and provide a minimum of 12 air changes per hour.
-

- 
- 3 Vent pipe: 316 stainless steel.

## **2.8 PIPING, FITTINGS AND VALVES**

- 1 Pipe: all interior station piping to be ductile iron Special Class 54 or as specified in the Project Documents.
- 2 Welded fittings: to ASTM A181.
- 3 Flanges to ANSI/ASME B-16.1, Class 125.
- 4 Wall pieces: wall pieces to have slip-on flanges, welded to pipe and located in center of the wall or as specified in the Project Documents. Exterior wall pieces to be cement-lined ductile iron, flanged inside and plain end outside. Exterior connections to force main to be by suitable coupling with joint restraint.
- 5 Install check valves and plug valves as specified in each pump discharge line. Each valve to have a throughway size equal to the pump discharge pipe size to ensure full, free-flow operation.

## **2.9 MISCELLANEOUS ITEMS**

- 1 Splash plate: fabricated from stainless steel.

## **2.10 ELECTRIC MOTOR**

- 1 The pump motor: squirrel-cage induction, inverter duty rated type design, housed in a watertight or dielectric oil-filled chamber of maximum efficiency and durability. Design motor for continuous duty capable of sustaining a minimum of fifteen (15) starts per hour. Motor speed and electrical characteristics as indicated in Project Documents.
  - 2 Motor stator: directly shrink-fitted into the stator housing. Insulate stator winding and leads with moisture-resistant varnish capable of withstanding a temperature of 155°C or the motors maximum temperature rise, whichever is greater. Insulation rating to Class F or higher.
  - 3 Rotor bars and short-circuit rings to be made of aluminum. Use thermal sensors to monitor stator temperatures on all pumps. Equip stator with not less than two (2) thermal switches embedded in the end coils of the stator windings (one switch per phase to protect the motor against surcharges and high temperature). Use these in conjunction with, and supplemental to, external motor overload protection, and wired to the control panel.
  - 4 Seal junction box chamber containing the terminal board from the motor by an elastomer compression grommet for pumps of 3 kW (4 hp) or more. Alternately, use of triple-sealed cable entry system does not require a seal junction box chamber.
  - 5 Equip air-filled motor housing with a moisture detector to detect any leakage of water or pumpage, into the stator housing. The signals from the thermal switches and the moisture detector to be wired to the control panel. Equip oil-filled motor
-

- housing with thermal switches only.
- .6 Integrate moisture sensor detection system consisting of two (2) probes within the oil- filled seal chamber which is isolated from the motor chamber. This sensor will provide early warning of lower seal failure.
  - .7 Accomplish control of the moisture detector and the winding thermal switches by using a control/indicator relay(s) which will be installed and wired inside the control panel to stop the pump unit upon a fault signal.
  - .8 Motors to be air cooled or oil cooled to manufacturer's standard.
  - .9 Motor to be able to operate dry without damage while pumping under load.

### **2.11 SHAFT AND SEALS**

- 1 Pump shaft: AISI 400 series stainless steel. Provide each pump with a tandem mechanical shaft seal system.
- 2 Tandem mechanical shaft seal to be of single spring design operating in an intermediate oil- filled seal cavity.
- 3 The upper of the tandem set of seals operates in cooling medium. This set contains one (1) stationary ring and one positively driven rotating ring.
- 4 Seals: silicon carbide or carbon ceramic.

### **2.12 ACCESS FRAME AND COVER**

- 1 Fabricate aluminum access frame using an extrusion of 6351 aluminum. Fabricate cover using a plate of 5086 aluminum designed to withstand shear and deflect not more than 1/79 of the maximum span for minimum specified loads of 7.2 kPa uniform load or 1100 kg point load. Cover to rest on a rubber gasket to be hinged along one side with a heavy-duty aluminum hinge.
  - 2 Top of the access frame to be flush, the handle recessed. Install padlock within the recess to lock the cover in the closed position.
  - 3 Provide cover stay to allow the cover to be locked in the open position.
  - 4 Each access frame to be capable of supporting the full weight of any submersible pump which can be installed through its opening.
  - 5 Design access frames for embedding into the concrete top of a sanitary sewer pump station, extrusion to be shaped such as to provide good anchoring to the concrete. All surfaces in contact with the concrete to be bitumastic coated.
  - 6 Frames to be capable of being installed side-by- side by bolting them together using standardized bolting kits.
  - 7 Provide aluminum rail nuts within the extrusions, permitting an upper guide holder, a level regulator hanger, and a chain hook to be attached without any modifications required to the frame.
  - 8 Clearly display a bilingual confined space warning label on the underside of the cover.
-

- 9 Provide a safety grate for fall through protection. When installed in pairs, install safety grates so that they open outward unless specified otherwise in the Project Documents.

### **2.13 LIQUID CONTROL**

- 1 Provide liquid level regulation to control the operation of the pumps in accordance with variations of sewage levels in the pump chamber.
- 2 Level control by mechanical switches (floats). Mercury liquid level switches are not permitted. Operating ranges should be as follows:
  - 1 Stop Lag Pump = 3.77m
  - 2 Stop Lead Pump = 3.82m
  - 3 Start Lead Pump = 4.12m
  - 4 Start Lag Pump = 4.42m
- 3 Provide mechanical switches for backup control as specified in the Project Documents.

### **2.14 PUMP CONTROL PANEL**

- 1 Pump manufacturer to supply a completely assembled control panel to provide alternating operation of the pump system and pump running time recorder.
- 2 Electro-mechanical and micro-processor control and SCADA interface as indicated in Project Documents.
- 3 Provide soft starters for pumps where required by agencies having jurisdiction.
- 4 House controls in NEMA 4X enclosure that is CSA approved.

### **2.15 ELECTRICAL WIRING**

- 1 Install only equipment essential for the operation of the pump station inside the wet well.
  - 2 Locate, where possible, all fans, heaters, switches and junction boxes, etc., outside the wet well to avoid corrosion or flood damage.
  - 3 All electrical wiring of the pump station to be designed and supplied by the manufacturer in accordance with the Canadian Electrical Code and CSA bulletin S2619.
  - 4 Provide pump power and level regulator cables in sufficient length to run directly to the control panel via an external conduit. Provide conduit fittings and strain relief connectors in sufficient number and size to permit installation of the conduit to the pumping station. External conduits to enter the control panel enclosure only through the bottom. Seal conduits with an approved gastight barrier, preventing entry of vapour or gas from the wet well into the control panel. Locate seal to enable motor removal complete with electrical disconnect without disturbing the seal. Where EYS seals are used, employ a rated junction box to allow for pump removal.
-

- 5 Code wiring in the pump station either by colour or a numbering system.
- 6 Provide pump power and level regulator (and automatic flush valve-optional) cables with sufficient length to run directly to the control panel (except where otherwise specified) and pull through external conduits.
- 7 Conductors in power wiring to be no less than No. 14 AWG. Control wiring conductors may be smaller in size, in accordance with the current requirements of the circuit involved and all applicable standards.
- 8 Provide separate conduit(s) for intrinsically safe devices.

## **2.16 LABELS**

- 1 Permanently affix suitable nameplates onto the pumps, motors, control enclosure components, and other operating components to indicate the purpose of the component or operating routine and parameters applying to the component. Confirm the lift station pumps and control equipment are CSA approved and the CSA logo appears on the nameplates of these components.

## **PART 3 - EXECUTION**

### **3.1 MANUFACTURER'S INSPECTION, TESTING AND SHIPMENT**

- 1 Inspection and Testing:
  - 1 Test pump proper operation at rated power supply values and for electrical and mechanical integrity prior to shipment. Pump supplier to have adequate test facilities to at least provide a single-point performance test or a complete performance curve at an accuracy of  $\pm 1\%$ . Check level regulators for correct operation.
  - 2 Pump/motor assembly to be CSA approved as one, integral unit, as per CSA standard CAN/CSA- C22.2. No. 108. Proof of this approval to be submitted by the pump manufacturer together with the approval drawings. An approval of the motor unit only will not be acceptable. Cable to be CSA approved, SOW type, neoprene-jacketed, with a 90°C rating.
  - 3 The supplier grants the right of inspection of the pumping equipment to any authorized representative of the purchaser or Owner's representative before shipment from factory. If inspection is requested give 48 hours notice in advance of the time when the equipment will be ready for inspection at the factory. The Owner will pay the costs associated with having an Engineer observe the testing.
  - 4 Have equipment in the pumping station that may have been provided by another supplier tested by the original supplier.
  - 5 Have the pump manufacturer perform the following inspections and tests on each pump before shipment:

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- .1 Check impeller, motor rating, and electrical connections for compliance to the customer's purchase order.
  - 2 A motor and cable insulation test for moisture content and/or insulation defects.
  - 3 Prior to submergence, run the pump dry to establish mechanical integrity and free rotation.
  - 4 Run pump for 30 minutes, submerged 2 m minimum depth.
  - 5 Repeat after operational test number 4, the insulation test, number 2.
  - .6 Check oil housing for any leakage of water by the lower seal.
  - .7 Inspect motor housing and junction box for any water leakage.
  - .8 Supply upon request, a written report stating that the above tests have been performed with each pump at the time of shipment.
  - .9 Seal pump cable end with a high quality protective covering to make it impervious to moisture and/or water seepage, prior to shipping to job site and electrical installation.
- .6 Provide successful test results prior to shipment.
- 2 Shipment: ship equipment assembled to the greatest extent possible to reduce installation and start-up costs.

### **3.2 PRE-INSTALLATION**

- .1 Verify layouts, dimensions, elevations and other pertinent data prior to proceeding with the work.
  - 2 Back-prime metal surfaces being mounted directly against concrete surfaces with bitumastic paint with the exception of surfaces that will be grouted in.
  - 3 Examine components to be incorporated into the Work for cracks, pits, blow holes, finishes, and any other defects. Do not incorporate any defective materials into the Work. Remove any defective materials from the site immediately and replace defective materials with new materials. Inspect materials and remove dirt and other debris.
  - 4 Install components in strict accordance with each manufacturer's instructions, recommendations, and the approved shop drawings for the various materials to be incorporated in the Work.
  - 5 Install pumps, pipe, fittings, valves, accessories and appurtenances using skilled workers experienced in the tasks required.
-

- .6 Handle all components carefully taking care not to damage the surface finish on these components. Make good any damage or supply new components as appropriate.
- .7 Install isolation bushings between stainless steel anchors and other dissimilar materials.
- .8 Install stainless steel washers when installing anchors for pump discharge base elbows. Washers to have a stick-on plastic film on the side contacting the base elbows. Use stainless steel shims similarly protected when shimming base elbows.
- .9 Arrange for start-up, testing and commissioning by the equipment manufacturers' representatives in presence of the Owner's representatives after the installation has been completed and is ready for start-up and commissioning.
- .10 Complete electrical installations to meet or exceed all applicable codes.

### **3.3 PIPING**

- .1 Cut piping to length using equipment designed for the cutting of pipe within the maximum allowable tolerance from square cut ends in accordance with type.
- .2 Lubricate pipe and gaskets with lubricant before installing gaskets on pipe and completing joint.
- .3 Install piping straight, parallel to walls and in such a manner so as to prevent straining during jointing procedures. Install galvanized pipe supports where shown or required.
- .4 Prior to assembling flanged joints, thoroughly clean flanges. Use a gasket lubricant to ease gasket installation. Tighten diametrically opposed bolts simultaneously.
- .5 Do not correct misalignment using fasteners or other means to pull flanges into alignment.
- .6 Correct so that no eccentric loads are placed on flanges.
- .7 Pipe penetrations in the wet well shall be circular. Seal penetrations with a modular elastomer sealing system in accordance with manufacturer's recommendations. Grout exterior face of penetrations.

### **3.4 VALVES**

- .1 Install valves in the correct orientation with respect to flow direction and in accordance with manufacturer's recommendations. Install isolation valves with the seat side down.
- .2 Install valves in waterproof chambers with access for maintenance or as specified in the Project Documents.

### **3.5 PUMPS AND APPURTENANCES**

- .1 Locate, align, level, adjust and install pump discharge base elbows. Locate pumps and discharge base elbows so that the pumps can be easily removed through the openings in the lift station without requiring the removal of any station
-

equipment. Confirm sufficient clearance is present to permit easy pump removal when a flush valve is installed on the designated pump.

- 2 Install upper guide bar or cable holders and guide bar(s) or cables in accordance with the pump and anchor manufacturer's instructions, so that the guide bars are true, plumb and in the proper location and alignment so that the pumps can be easily removed through the openings in the lift station cover.
- 3 Take care to protect the finish on the pumps, pipe, fittings, valves and appurtenances from scratches and other damage. Repair any damage to the surface finishes.

### **3.6 ACCESORIES**

- 1 Construct level regulator hanger of aluminium steel and mount in the position indicated or as directed by the Engineer. The level regulator hanger(s) will otherwise be mounted in a location where it will not be affected by flow from the inlet piping or prevent removal of the pumps, including a pump if fitted with flush valve, all in accordance with the pump and anchor manufacturer's instructions.
- 2 Back-prime and mount each galvanized chain hook or cable in the area shown and located so that the chain can be reached conveniently and such that the hook does not interfere with pump removal from the lift station. Install isolation bushings between galvanized steel and 316 stainless steel anchors. Install hooks in accordance with pump and anchor manufacturer's instructions.
- 3 Supply and install back-primed galvanized pipe supports and install with medium duty, 316 stainless steel, wedge anchors using isolation bushings all in accordance with the anchor manufacturer's instructions.
- 4 Following installation of the stainless steel anchors that use studs instead of bolts, cut the studs off level with the top of the nut.

### **3.7 TESTING AND COMMISION**

- 1 Test interior pipework: gradually increase water inside pipework until it reaches a minimum of 690 kPa and maintain test pressure for one hour. No leakage will be allowed.
  - 2 Prior to starting the pumps, remove the plug or cap from the forcemain in the manhole.
  - 3 After pumps and piping have been installed, test pumps with the material they are to pump, or with water, operate and pump for a duration of time sufficient to satisfy that the complete installation has been properly installed and aligned and that the pumps run free from heating, rubbing or vibration and meet the requirements of these Specifications, and that the pumps and piping are free and clear of debris and obstructions.
  - 4 Demonstrate each pump can be easily removed from the lift station without obstruction or removal of any station equipment. Make any adjustments necessary to carry out pump removal in this manner.
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- 5 Demonstrate the operation of all valves and make any adjustments necessary to permit the valves to be operated smoothly without obstruction and allow the pumps to be removed with the valves in an open or closed position.
- 6 Demonstrate integrity of pump discharge connection seal to pump by pumping down wet well sufficiently to detect leakage.
- 7 Observe wet well and valve chamber piping during pump operation for leaks and/or loose connections. Repair any leaks identified.
- 8 Test station piping in accordance with Section 33 34 00, Clause 3.9.
- 9 Test pump flow in accordance with specified pump curves stated for pump characteristics. Test pump flow by draw down test, flow meter or SCADA as directed by the Engineer.

END

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## **PART 1 - GENERAL**

### **1.1 WORK INCLUDED**

- .1 This section specifies requirements for constructing pressure sewers and appurtenances. Work includes supply, installation and testing of pipe, fittings and service connections.

### **1.2 RELATED SECTIONS**

- |    |   |                  |
|----|---|------------------|
| .1 | Concrete                                      | Section 03 30 00 |
| .2 | Metal Fabrications                            | Section 05 50 00 |
| .3 | Earthwork                                     | Section 31 20 00 |
| .4 | Reinstatement                                 | Section 32 98 00 |
| .5 | Precast Manholes, Catch Basins and Structures | Section 33 39 00 |
| .6 | Standard Details                              | Section 03 30 00 |

### **1.3 REFERENCE STANDARDS**

- .1 ASME B16.1-2015, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
  - .2 ASTM F2164-2018, Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.
  - .3 AWWA C104/A21.4-16, Cement Mortar Lining for Ductile - Iron Pipe and Fittings for Water.
  - .4 AWWA C110/A21.10-12, Ductile-Iron and Gray-Iron Fittings.
  - .5 AWWA C111/A21.11-17, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - .6 AWWA C151/A21.51-17, Ductile-Iron Pipe, Centrifugally Cast, for Water.
  - .7 AWWA C153/A21.53-19, Ductile Iron Compact Fittings.
  - .8 AWWA C301-14, Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
  - .9 AWWA C302-16, Reinforced Concrete Pressure Pipe, Non-cylinder Type.
  - .10 AWWA C303-17, Reinforced Concrete Pressure Pipe, Bar-Wrapped, Steel Cylinder Type.
  - .11 AWWA C504-15, Rubber-Seated Butterfly Valves.
  - .12 AWWA C509-2015, Resilient-Seated Gate Valves for Water Supply Service.
  - .13 AWWA C512-15, Air Release, Air/Vacuum, and Combination Air Valves for Waterwork and Wastewater Service.
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- .14 AWWA C515-15, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
- .15 AWWA C900-16, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In., (100mm Through 1,500mm).
- .16 AWWA C901-17, Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13mm) Through 3 In. (76mm), for Water Service.
- .17 AWWA C906-15, Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100mm) Through 65 In. (100mm Through 1,650mm), for Waterworks.
- .18 AWWA C909-16, Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe 4In. and Larger.
- .19 CAN/CSA B137 Series-19, Thermoplastic Pressure Piping Compendium.
- 20 CAN/ULC S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

#### **1.4 SHOP DRAWINGS**

- 1 Submit shop drawings in accordance with Section 01 10 00 for items listed in Supplementary Specifications.
- 2 For concrete pressure pipe and fittings, submit tabulated materials list and drawings indicating internal pressure rating, maximum external load, type of joints and identification mark numbers.

#### **1.5 CERTIFICATES**

- 1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 10 00 for items listed in Supplementary Specifications.
- 2 For fusion butt jointing for polyethylene pipe provide certification that personnel are trained by manufacturer in current methods and use of equipment.

#### **1.6 HANDLING AND STORAGE**

- 1 Handle and store pipe, valves, fittings, in such a manner as to avoid damage. Do not use chains or cables passed through pipe bore. Do not damage coatings or linings.
- 2 Store gaskets in accordance with the manufacturer's written instructions.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

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- .1 Diameter, material and strength class of pipe and fittings: as indicated in the Project Documents.

## **2.2 POLYVINYL CHLORIDE PIPE AND FITTINGS**

- .1 Pipe and Joints: to CSA B137, AWWA C900 or AWWA 909, cast-iron outside diameter, gasketed bell- end Joint.
- 2 Fittings:
  - .1 PVC: to CAN/CSA B137.
  - 2 Cast or ductile-iron: to AWWA C110 and C153, cement mortar lined, minimum pressure rating 1035 kPa for cast, 1720 kPa for ductile iron.
  - 3 Cement mortar lining: to AWWA C104. Provide internal seal coat when required by Project Documents.
  - 4 Joints, mechanical or push-on: to AWWA C153.
- 3 Fusible PVC pipe and joints:
  - .1 100mm diameter and larger: to CSA B137, AWWA C900.
  - 2 Joints: thermal butt fusion.
  - 3 Have fusion services performed by a qualified and certified fusible PVC technician.

## **2.3 POLYETHYLENE PIPE AND FITTINGS**

- .1 Pipe:
  - .1 13 to 76mm diameter: to AWWA C901.
  - 2 100mm diameter and larger: to AWWA C906.
- 2 Joints:
  - .1 Thermal Butt Fusion
  - 2 Mechanical Connections: polyethylene flange end with metal back-up ring.
  - 3 Electrofusion.
- 3 Fittings:
  - .1 Polyethylene: to AWWA C901 and AWWA C906.
  - 2 Flanged cast-iron: to AWWA C110.

## **2.4 GATE VALVES**

- .1 Buried: to AWWA C509 or C515 up to 300mm, minimum pressure rating 1380 kPa and as follows:
  - .1 Body: cast-iron with mechanical joint ends.
  - 2 Mechanism (AWWA C509, C515): wedge disk with resilient rubber seat ring and machined seating surface, non-rising spindle, and O-ring seals.

- 3 Direction of opening: counterclockwise.
- 4 Operating Nut: 50mm square.
- 5 Provide centering disc.
- 2 In chamber: to AWWA C509 or C515, minimum pressure rating 1380 kPa and as follows:
  - 1 Body: cast-iron with Class 125 flanged ends to ASME B16.1.
  - 2 Mechanism (AWWA C509 or C515): wedge disc with resilient rubber seat ring and machined seating surface, outside stem and yolk, rising stem and handwheel.

## **2.5 VALVE BOXES**

- .1 Valve boxes:
  - 1 Cast-iron, slide type, adjustable for depth of pipe below finished grade or composite valve box.
  - 2 Covers marked "Sewer".
  - 3 Lugged to prevent turning and rolling of cover, and cover notched to suit.

## **2.6 THRUST RESTRAINT**

- 1 Thrust blocks and anchors: 20MPa Portland cement concrete and 15M, Grade 400 reinforcing steel where indicated.
- 2 Mechanical joint restraint device: (100mm to 600mm) ductile iron follower gland to AWWA C153 and AWWA C111 with multiple wedge restraining mechanism, minimum pressure working rating 2410 kPa and minimum safety factor of 2:1 lugs to have twist-off torque nut.

## **2.7 INSULATION**

- 1 Insulation: to CAN/ULC S701, Type 4, polystyrene.

## **2.8 TRACER WIRE**

- 1 RWU90, number 10 gauge (AWG), single insulated copper wire with 60mil of black cross-linked polyethylene (XCPE) insulation specifically manufactured for direct burial application or approved equivalent.
- 2 Make all spliced or repaired wire connections in the tracer wire system waterproof using an approved buried service wire closure.
- 3 Provide test stations as indicated in Project Documents.

## **2.9 MARKER TAPE**

- 1 Detectable metallic tape, 50mm wide, clearly marked as follows:
    - 1 "CAUTION - BURIED SEWER LINE", coloured green.
-

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- .1 Inspect material for defects and remove defective materials from site.
- .2 Before installation, remove any water, debris, and foreign material from interior of pipe, fittings and valves.

### **3.2 TRENCHING AND BACKFILLING**

- .1 Do trenching, bedding and backfilling to Section 31 20 00.

### **3.3 PIPE INSTALLATION**

- .1 Lay and join pipe, fittings, and valves as specified herein and according to manufacturer's published instructions.
- .2 Lay pipe and fittings on prepared bed, true to line and grade indicated, within following tolerances:
  - .1 Horizontal Alignment: 150mm
  - .2 Vertical Alignment: 75mm
- .3 Face bell ends in direction of laying. On grades of 5% or greater lay pipe up grade.
- .4 Do not exceed maximum joint deflection recommended by manufacturer.
- .5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.
- .6 Join pipes in accordance with manufacturers published instructions.
- .7 Install gaskets in accordance with manufacturers published instructions. Use only lubricant supplied by manufacturer. During cold weather store gaskets in heated area to maintain flexibility.
- .8 Align pipes before joining.
- .9 Support pipes as required to assure concentricity until joint is properly completed.
- .10 Keep pipe joints free from soil or other foreign materials.
- .11 Avoid displacing gasket or contaminating with dirt, petroleum products or other foreign material. Remove, clean, re-install and lubricate gaskets so disturbed.
- .12 Complete each joint before laying next length of pipe.
- .13 For concrete pressure pipe, install diapers and pour cement mortar into joint recess. Fill inside joint recess with stiff cement grout.
- .14 Where deflection at joints is permitted, deflect only after joint is completed.
- .15 At structures provide flexible joint not more than one (1) metre from outside face of structure.
- .16 Cut pipe as required for specials, fittings or closure pieces, square to centerline, and as recommended by manufacturer. Do not damage pipe lining or coating and

leave smooth beveled edge.

- .17 Provide concrete thrust blocks to undisturbed ground on all tees, bends, plugs and caps. Construct as indicated and keep joints and couplings free of concrete.
- .18 Install mechanical joint restraint to AWWA C111 and tighten lug nuts until all wedges are in firm contact with pipe surface. Continue to tighten alternating between bolts until lug nuts twist off.
- .19 Place marker tape upon bedding surround of plastic pipe.

### **3.4 VALVES AND VALVE BOXES**

- 1 Install valves at locations indicated. Joints and bedding as for pipe and fittings.
- 2 On direct buried valves, install valve boxes perpendicular to surface, centered over operating nut, using centering disc, and true to line and grade.
- 3 Use thrust anchors for valves greater than 150mm on PVC and polyethylene pipe.

### **3.5 TRACER WIRE**

- 1 Install tracer wire on all non-ductile iron pressure sewer. Install the wire in such a manner so as to be able to properly trace all pressure sewer without loss or deterioration of signal or without the transmittal signal migrating off the tracer wire.
- 2 At the point of connection between and cast and ductile iron pressure sewer with any non-iron pressure sewer, connect the tracer wire to the first valve box or as directed by the Engineer.
- 3 Lay tracer wire flat and securely affix to each pipe at three (3) evenly spaced locations. Protect the wire from damage during the excavation of the works. No breaks or cuts in the tracer wire insulation will be permitted. At service saddles, do not place the tracer wire between the saddle and the main.
- 4 Except for approved splices in connections, tracer wire must be continuous and without splices.
- 5 Test the tracer wire system for functionality after it has been confirmed and demonstrated that the entire tracer wire system is installed and is functioning properly.

### **3.6 MARKER TAPE**

- 1 Install Place marker tape in trench upon bedding surround of plastic pipe.

### **3.7 HYDROSTATIC LEAKAGE TESTING**

- 1 Notify Engineer at least 24 hours in advance of all proposed tests. Perform tests in presence of the Engineer.
- 2 If water used for flushing or testing is obtained from a potable water supply, continuously separate the supply from the service being flushed or tested by an air gap or a level of protection equal to or greater than that provided by a double

- 
- check valve backflow prevention device.
- 3 Provide labour, equipment and materials required to perform hydrostatic and leakage tests.
  - 4 Backfill prior to testing.
  - 5 Open all valves in test section.
  - 6 Expel air from main by slowly filling with water. Install corporation stops at high points where no air-vacuum release valves are installed. After testing, remove corporation stops and install plugs.
  - 7 Fill concrete pipe 24 hours before testing to allow for absorption of water.
  - 8 Apply test pressure of 1035 kPa or pressure equal to 1.5 times working pressure, whichever is greater, measured at lowest point in test section. Conduct the test over a full two (2) hour period, maintaining a constant test pressure. No leakage is permitted by the test process.
  - 9 Test polyethylene pipe in accordance with ASTM F2164.
  - .10 Locate and repair defects if test fails. Retest.

### **3.8 FLUSHING**

- 1 Notify Engineer 24 hours in advance of flushing.
- 2 If water used for flushing or testing is obtained from a potable water supply, the supply is to be continuously separated from the service being flushed or tested by an air gap or a level of protection equal to or greater than that provided by a double check valve backflow prevention device.
- 3 Flush mains with water through available outlets with sufficient flow to produce minimum velocity in main of 0.9 m/s, for 10 minutes. Flush until foreign materials have been removed and water is clear.
- 4 Slowly open and close valves to confirm thorough flushing.

## **PART 1 - GENERAL**

### **1.1 WORK INCLUDED**

- 1 This section specifies requirements for constructing precast concrete manholes, catchbasins and structures. Work includes supply and installation of concrete bases, precast sections, metal castings and testing.

### **1.2 RELATED SECTIONS**

1	Concrete	Section 03 30 00
2	Metal Fabrications	Section 05 50 00
3	Earthwork	Section 31 20 00
4	Water Mains	Sectuib 33 11 00
5	Sanitary Sewers	Section 33 31 00
6	Pressure Sewers	Section 33 34 00
7	Precast Manholes, Catch Basins and Structures	Section 33 39 00
8	Standard Details	Section 03 30 00

### **1.3 REFERENCE STANDARDS**

- 1 ASTM A48/A48M-03(R2012), Gray Iron Castings.
- 2 ASTM C478M-15A, Precast Reinforced Concrete Manhole Sections (Metric)
- 3 CAN/CSA A257 Series-14, Standards for Concrete Pipe and Manhole Sections.
- 4 CAN/ULC S701-2011, Thermal Insulation, Polystyrene Boards and Pipe Covering

### **1.4 SHOP DRAWINGS**

- 1 Submit shop drawings in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

### **1.5 HANDLING AND STORAGE**

- 1 Prevent damage to materials during storage and handling in accordance with the manufacturer's written instructions.
- 2 Store gaskets in cool location out of direct sunlight, and away from petroleum products.

## **PART 2 -PRODUCTS**

### **2.1 GENERAL**

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- .1 Prevent damage to materials during storage and handling in accordance with the manufacturer's written instructions.

## **2.2 PRECAST BASES AND SECTIONS**

- .1 Precast Concrete Bases and Sections: to ASTM C478M or CSA A257.

## **2.3 GASKETS**

- .1 O-Rings: to manufacturer's standard.
- .2 Bituminous Compound: precast manufacturer's recommended compound.

## **2.4 METAL CASTINGS**

- .1 Frames, covers and gratings: to ASTM A48, gray cast iron, factory coated.

## **2.5 WATERPROOFING**

- .1 Waterproofing: type specified in the Project Documents.

## **2.6 INSULATION**

- .1 Rigid Insulation: to CAN/ULC S701, Type 4, extruded polystyrene.

## **2.7 CONCRETE**

- .1 Concrete: to Section 03 30 00, at 28 days, slump 80mm ±20mm minimum compressive strength of 35 MPa, and maximum water cement ratio of 0.45, air entrainment, 5 - 8% total air content.
- .2 Grade Adjustment: manufactured type or cast-in- place type as indicated.

## **2.8 NON-SHRINK GROUT**

- .1 Pre-mixed, dry pack or pourable type containing non-metallic aggregate, plasticizing agents and cement, minimum compressive strength of 45 MPa at 28 days.

## **2.9 LADDERS**

- .1 In accordance with the Project Documents.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- .1 Inspect products for defects and remove defective products from site.
-

### **3.2 EXCAVATION AND BACKFILL**

- .1 Excavate and backfill to Section 31 20 00.

### **3.3 INSTALLATION**

- .1 Construct units as indicated.
- .2 Complete units as pipe laying progresses.
- .3 Cast or set base on 150mm thick pipe bedding or material as indicated in the Project Documents compacted to 95% Standard Proctor Density or as indicated in the Project Documents. Top of base to be level.
- .4 Place stubs at elevations and in positions indicated. Provide flexible pipe joints within 1 metre of outside face of poured-in-place and precast structure where there is no in-wall gasket for pipe sizes up to and including 750mm diameter.
- .5 Form manhole bases to provide smooth U-shaped channels with depth equal to diameter of pipes or as indicated. Curve channels smoothly and slope uniformly from inlet to outlet. Benching to drain towards channel, 4% maximum slope.
- .6 Install base section of precast shafting on cast-in-place base as indicated and assure watertight joint.
- .7 Install gaskets in accordance with manufacturer's published instructions.
- .8 Install precast sections plumb and true with opening centered over upstream pipe.
- .9 Make all joints watertight in sanitary sewer manholes and valve chambers.
- .10 Install ladder if required by Project Documents.
- .11 Set frame and cover or grating to elevation and slope indicated. Use cast-in-place concrete for adjustment and secure frame in place with cement grout or use manufactured type.
- .12 Clean debris and foreign material from unit. Remove fins and sharp projections. Prevent debris from entering system.

### **3.4 TESTING**

- .1 Test sanitary sewer manholes and structures.
- .2 Provide labour, equipment and materials required to perform testing.
- .3 Backfill prior to testing.
- .4 Notify Engineer 24 hours in advance of proposed test. Do test in presence of Engineer.
- .5 Test method: as indicated and in accordance with the authority having jurisdiction.
- .6 Perform water test as follows:
  - .1 If water used for flushing or testing is obtained from a potable water supply, the potable water supply is to be continuously separated from the service being flushed or tested by an air gap or a level of protection equal to or greater than that provided by a double check valve backflow

prevention device.

- 2 Plug all inlet and outlet pipes with watertight plugs.
- 3 Fill with water to top of precast sections.
- 4 Allow time for initial absorption.
- 5 Measure and record volume of water required to maintain level for one hour.
- 6 Leakage not to exceed 5.0 litres per hour per 1000mm diameter per 1000mm of height above groundwater.
- 7 Locate and repair defects if test fails. Retest using same methodology.
- 8 Repair leaks regardless of test results.

## **PART 1 - GENERAL**

### **1.1 WORK INCLUDED**

- .1 This section specifies requirements for constructing storm sewers and culverts. Work includes supply and installation of pipe, fittings and service connections.

### **1.2 RELATED SECTIONS**

- |    |   |                  |
|----|---|------------------|
| .1 | Concrete                                      | Section 03 30 00 |
| .2 | Metal Fabrications                            | Section 05 50 00 |
| .3 | Earthwork                                     | Section 31 20 00 |
| .4 | Reinstatement                                 | Section 32 98 00 |
| .5 | Precast Manholes, Catch Basins and Structures | Section 33 39 00 |
| .6 | Standard Details                              | Section 03 30 00 |

### **1.3 REFERENCE STANDARDS**

- .1 ASTM C14M-15A, Concrete Sewer, Storm Drain, and Culvert Pipe (Metric).
- .2 ASTM C76M-19B, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).
- .3 ASTM D1056-14, Flexible Cellular Materials - Sponge or Expanded Rubber.
- .4 CAN/CSA G401-14(R2019), Corrugated Steel Pipe Products.
- .5 CAN/CSA A257 Series-19, Standards for Concrete Pipe and Manhole Sections.
- .6 CAN/CSA B1800 Series-18, Thermoplastic Non- Pressure Piping Compendium.
- .7 National Association of Sewer Service Companies (NASSCO) Pipe Condition Assessment Using CCTV Performance Specification Guideline.

### **1.4 CERTIFICATES**

- .1 Upon request, submit manufacturers' test data and certification that products and materials meet requirements of this Section in accordance with Section 01 10 00 for items listed in Supplementary Specifications.

### **1.5 HANDLING AND STORAGE**

- .1 Handle and store pipe and fittings in such a as to avoid damage. Do not use chains or cables passed through pipe bore.
- .2 Store gaskets in accordance with the manufacturer's written instructions.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- .1 Diameter, material, strength class and dimensional ratio of pipe and fittings: as indicated.
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## **2.2 CONCRETE PIPES AND FITTINGS**

- .1 Pipe and Fittings: reinforced, to ASTM C 76M or CAN/CSA A257.2.
- .2 Joints: bell and spigot with flexible rubber gaskets to CAN/CSA A257.3-M.

## **2.3 GROUT**

- .1 Non-shrink: to Section 03 30 00.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- .1 Inspect products for defects and remove defective products from site.
- .2 Confirm pipe and fittings are clean before installation.

### **3.2 EXCAVATING BEDDING AND BACKFILLING**

- .1 Perform excavation, bedding and backfilling in accordance with Section 31 20 00.

### **3.3 PIPE INSTALLATION**

- .1 Lay and join pipe and fittings as specified herein and according to manufacturer's published instructions.
- .2 Lay pipe and fittings on prepared bed, true to line and grade indicated within following tolerances:
  - .1 Horizontal Alignment: 50mm.
  - .2 Vertical Alignment: the lesser of 13mm or one half the rise per pipe length.
- .3 Commence laying at outlet and proceed in upstream direction with bell ends facing upgrade.
- .4 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipelaying is not in progress.
- .5 Install gaskets in accordance with manufacturers published instructions.
- .6 Align pipe before joining.
- .7 Support pipes as required to achieve concentricity until joint is properly completed.
- .8 Keep pipe joints free from mud, silt, gravel or other foreign material.
- .9 Avoid displacing gasket or contaminating with dirt, petroleum products, or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.
- .10 Complete each joint before laying next length of pipe.
- .11 Where deflection at joints is permitted, deflect only after the joint is completed.

- Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .12 Where a flexible joint is not integral to the structure, provide flexible joint not more than 1 metre from outside face of structure.
  - .13 For corrugated steel pipe match corrugations or indentation of coupler band with pipe sections before tightening. Tap coupler firmly while tightening to take up slack and confirm a snug fit. Ensure all bolts are inserted and tightened.
  - .14 Install plastic pipe in accordance with CAN/CSA B1800.
  - .15 Cut pipe as required for fittings or closure pieces, square to centreline, and as recommended by manufacturer.
  - .16 Make watertight connections to manholes and catch basins. Do not use non-shrink grout unless approved by Engineer.

### **3.4 INSPECTION**

- .1 Engineer may require sewers by television inspection of installed camera, photographic camera or by other visual method.

### **3.5 CLOSED CIRCUIT TELEVISION INSPECTION**

- .1 Flush storm sewers and related appurtenances to remove foreign materials.
- .2 Conduct closed circuit television inspection procedures to meet National Association of Sewer Service Companies (NASSCO) Pipe Condition Assessment Using CCTV Performance Specification Guideline.
- .3 Equipment:
  - .1 Provide equipment meeting following requirements:
    - .1 Self-contained, self-leveling monitoring unit and pan-tilt camera with remotely controlled lighting system capable of varying the illumination.
    - .2 Picture quality to produce continuous 600-line resolution picture, showing entire periphery of pipe.
    - .3 A meter device with readings to clearly identify exact location of camera.
- .4 Inspection:
  - .1 Perform inspection of pipe from manhole to manhole by passing TV camera through sewer in direction of flow.
  - .2 Classify results in accordance with NASSCO Performance Specification Guideline.
- .5 Records:
  - .1 Maintain inspection record in log form, during television inspection.
  - .2 Log to include location of each fault and service lateral distance measured from centreline of reference manhole and position referenced to axis of pipe.

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- .3 Provide fault image from inspection record. All photographs to be clear and precise with distinct definition of fault.
  - .4 Include detailed technical description with images as supporting data for each fault.
  - .5 Provide minimum of two (2) images for each sewer main section, detailing typical joint, and typical building service lateral.
  - .6 All images and videos to be in colour.
  - .6 Reports:
    - .1 Provide a composite report of TV inspection in PDF format. Include following information:
      - .1 Title page identifying project, camera operator and dates of inspection.
      - .2 Index page identifying street name, section from manhole to manhole, page number or numbers where information for section is contained.
    - .2 Organize inspection records in sequence from upstream manhole to downstream manhole.
    - .3 Report on each sewer main section to contain:
      - .1 Heading:
        - .1 Street name.
        - .2 Manhole numbers applicable to section.
        - .3 Reference drawing number, if applicable.
        - .4 Weather on the day of inspection.
        - .5 Statement of soil condition in area of inspection, i.e., dry, damp, wet, frozen.
        - .6 Date of inspection.
      - .2 Key Plan, showing corresponding manhole numbers, magnetic north, horizontal distance, pipe and material between manholes, and direction of flow.
      - .3 Inspection findings for each sewer main section to include:
        - .1 Location of all faults.
        - .2 Images of all faults.
        - .3 Location of all service laterals.
        - .4 One image each of typical joint and typical service laterals when faults are not found.
      - .4 Mount images on left-hand page and place corresponding description on right-hand page. Number all images in order. Number beside photograph to correspond with description number.
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- .7 Accuracy:
    - .1 Maximum permissible error in accuracy to be within following limits of fault location:
      - .1 Up to 375mm pipe:  $\pm 75$ mm per 100 m of length.
      - .2 450mm - 600mm pipe:  $\pm 150$ mm per 100 m of length.
      - .3 750mm - 900mm pipe:  $\pm 225$ mm per 100 m of length.
  - .8 Video Record:
    - .1 Supply a complete record of all inspections in digital format.
    - .2 Index all files, listing sections of inspections.
    - .3 Submit flash drive with PDF report to Engineer.
  - .9 Repeat Inspection:
    - .1 Prior to repairs, have methods reviewed by Engineer. Repair faults detected during television inspection. Repeat television inspection at no additional cost.

## **PART 1 - GENERAL**

### **3.6 RELATED REQUIREMENTS**

- .8 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

### **3.7 REFERENCES**

- .7 CSA C22.2 No. 211.2-06(R2011), Rigid PVC (Unplasticized) Conduit.

### **3.8 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

### **3.9 QUALITY ASSURANCE**

- .1 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Certificates: signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
  - .2 Manufacturer's Instructions: for installation and special handling criteria, installation sequence and cleaning procedures.

### **3.10 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **PART 2 - PRODUCTS**

### **2.1 RIGID PVC CONDUITS**

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- .1 Rigid PVC conduits to CSA C22.2 No. 211.2.
- .2 Rigid PVC couplings, reducers, plugs, caps, adaptors, and supports to make a complete installation.
- .3 Expansion joints as recommended by manufacturer and as required.

## **2.2 CABLE PULLING EQUIPMENT**

- .1 6 mm stranded nylon pull rope tensile strength 5 kN.

## **2.4 WARNING TAPE**

- .1 Standard 4-mil polyethylene 76 mm wide tape, yellow with black letters, imprinted with "CAUTION BURIED ELECTRIC CABLE BELOW".

## **PART 3 - EXECUTION**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 INSTALLATION**

- .1 Install duct pipe in accordance with manufacturer's instructions and at elevations as indicated.
  - .2 Clean inside of ducts before laying.
  - .3 Install plastic duct spacers and ensure full, even support every 1.5 m and smooth transition throughout duct length.
  - .4 Slope ducts with 1 to 400 minimum slope.
  - .5 Install plugs and cap both ends of ducts to prevent entrance of foreign materials during and after construction.
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- .6 Pull through each duct steel wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign material.
  - .1 Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .7 Install a pull rope continuous throughout each duct run with 3 m spare rope at each end.
- .8 Place continuous strip of warning tape 1/2 way between installation and grade level before backfilling trenches.
- .9 Install markers as required.
- .10 Notify the Departmental Representative for field review upon completion of direct buried ducts and obtain acceptance prior to backfill.

### **3.3 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END

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